

# Annual Progress Report (APR)



2022 Air Quality Annual Progress Report (APR) for Dundee City Council

In fulfilment of Part IV of the Environment Act 1995

Local Air Quality Management

October 2022

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# Executive Summary: Air Quality in Our Area

## Air Quality in Dundee

In 2006 Dundee City Council (DCC) declared the whole of DCC local authority area as an 'Air Quality Management Area' (AQMA) for the nitrogen dioxide (NO<sub>2</sub>) annual mean Air Quality Objective (AQO). A single AQMA rather than several connecting AQMAs was declared to enable wider consideration of air quality improvements in Dundee. In 2010, DCC amended the initial AQMA to include the annual mean AQO for particulate matter (PM<sub>10</sub>) and in 2013 DCC further amended the AQMA to include the 1-hour mean AQO for NO<sub>2</sub>. In line with other cities, the predominant source contributing to these exceedances is road traffic.

DCC published its 'Air Quality Action Plan' in January 2011, introducing a set of 32 measures to work towards achievement of the AQOs in the AQMA. The implementation of these measures has helped to reduce pollutant levels across the local authority, with the number of exceedance locations greatly reducing over the 11 years that the AQAP has been in place.

Dundee City Council currently monitors for NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>, the latest results and trends are discussed in Chapter 3. Additional analysis is also available on the Air Quality in Scotland website within the 2021 annual summary report prepared by Ricardo Energy & Environment - [https://www.scottishairquality.scot/assets/reports/365/Dundee\\_City\\_annual\\_2021.html](https://www.scottishairquality.scot/assets/reports/365/Dundee_City_annual_2021.html).

The 2021 monitoring results indicate compliance with the air quality objectives for these pollutants at all locations where continuous monitoring was undertaken. One of the 88 passive diffusion tube (PDT) monitoring locations indicated a potential exceedance of the NO<sub>2</sub> annual mean objective however, after distance correction, the predicted concentration at the relevant receptor was compliant with the objective.

The lockdown measures imposed during 2020 in response to the COVID19 pandemic resulted in a dramatic drop in road traffic within Scotland's cities, including Dundee. It is well established that road traffic is the main source of oxides of nitrogen (NO<sub>x</sub>) within cities and therefore measured NO<sub>2</sub> concentrations is influenced greatly by changes to daily traffic flow levels. Traffic data collected by the Council's automated traffic counters indicates that traffic levels in 2021 remained lower during the first half of the year but had increased to nearer pre-pandemic levels by the end of the year. It is suggested also that the AM and PM peaks are lower than pre-pandemic, with there being a greater distribution of the daily flow across the period of the day.

During 2021 Dundee City Council continued to work with Transport Scotland, Scottish Environment Protection Agency (SEPA) and the regional transport partnership (Tayside and Central Scotland Transport Partnership - TACTRAN) to develop a Low Emission Zone (LEZ) scheme for Dundee,

which is due to be introduced by the end of May 2022. SEPA also include the local authority on any new industrial process applications within the local authority boundary, and provide an annual update on existing processes in the city that they are the regulators for. Unfortunately SEPA advised that they were unable to provide a 2021 update on the existing processes within Dundee for this report.

### **Actions to Improve Air Quality**

Dundee City Council has taken forward a number of measures during the current reporting year of 2021 in pursuit of improving local air quality. Actions taken during the past year have included:

- There was a 14% increase in the number of members to the Dundee ECO Stars commercial vehicles scheme, with 245 members (8405 vehicles). The number of members of the ECO Stars scheme for taxis/private hire vehicles was maintained at 18 operators (570 vehicles) during 2021.
- Construction of the Active Travel Hub at the Dundee Waterfront was completed in 2021 with this opening to the public in September 2021.
- The Drive Dundee Electric campaign continued to help raise awareness and encourage uptake of low emission vehicles through media publications and at various events throughout the year. Showcase events included events held the lead up to COP26 in November 2021, including the city hosting the 2021 EVI Global Pilot City Forum, in partnership with the International Energy Agency.
- The Dundee City Council Fleet section continued to replace older vehicles with newer, less polluting models. During 2021, 24 diesel vehicles were replaced with electric vehicles. In total, 41 fully electric vehicles were added to the fleet, including four more fully electric refuse collection vehicles. By the end of 2021, there was a total of 171 electric vehicles within the council fleet.
- At the end of 2021 there were 165 pure electric taxis in Dundee, up from 161 in 2020.
- Solar canopies were installed on the salt dome at Marchbanks Depot to provide renewable power for the Heavy Goods Vehicle charging hub installed there. The charging hub at the Olympia multi-story carpark opened to the public in February 2021.
- The city's first pop-up chargers were installed at the V&A Museum in May 2021. The number of pop-up chargers installed throughout the city totalled 26 during 2021.
- 'Clean Air Day 2021' was promoted via social media channels on June 17 to help raise awareness of air quality and how we can protect those most vulnerable to the impacts of exposure to poor air quality.

- A School Streets (vehicle exclusion zone) launched at Fintry PS in September 2021.
- Road infrastructure improvements for Lochee Road at Cleghorn Street / Rankine Street were approved to benefit road safety and to help ease congestion caused by vehicles turning right into these streets from Lochee Road. Other options for alterations along the Lochee Road corridor to ease congestion were progressed with air quality modelling of these to be undertaken in 2022. Bus priority measures were introduced on Meadowside in March 2021.
- A further five docking stations for the Embark electric bike hire scheme were progressed in 2021.
- New segregated cycle lanes were implemented in Perth Road and Ninewells Avenue while sections of the Broughty Ferry cycle route received improvements to lighting during 2021.
- Statutory consultation on the preferred option for the Dundee Low Emission Zone scheme was undertaken in the summer of 2021, with the preferred option then approved for progression as the proposed scheme. The proposed scheme, which includes an area within the inner-ring road of the city centre of Dundee and is applicable to all vehicle types other than motorcycles / mopeds, was then advertised in November and December 2021, with objections to the scheme being accepted during these periods.

### **Local Priorities and Challenges**

Air Quality Action Plan linked measures to be progressed over the course of the next reporting year include:

- Continuation of both ECOSTARS Schemes for Heavy Duty Vehicles and Taxis / Private Hire vehicles to encourage engagement with and participation of these transport providers in the achievement of air quality improvements in the city.
- Continued support for Active Travel related projects including the delivery of the School Active Travel Delivery programme and behaviour change campaigns to cycling, active and sustainable travel across the city via joint working with the Dundee Cycle Hub.
- Work will continue with SEPA on the modelling of air quality impacts of road infrastructure improvements on the Lochee Road corridor, with traffic counts scheduled for March 2022.
- Work will progress on expanding the School Streets (vehicle exclusion scheme) to five more locations in 2022.
- The promotion of Clean Air Day 2022 on 16 June 2022 to help raise awareness of air quality, with this year's theme being *"Air pollution dirties every organ in your body. Take steps to improve your health this Clean Air Day."*

- A project to provide residential cycle storage solutions in areas of Dundee where there is a high level of flatted development and tenements will commence.
- A review and update of the existing 2011 Air Quality Action Plan will progress, aligning changes that have occurred across Dundee since the initial plan was published plus improvements predicted to occur as a result of the LEZ, and action measures contained within the Scottish Governments 'Cleaner Air for Scotland 2 – Towards a Better Place for Everyone' air quality strategy that was published in 2021.
- Following approval by the Scottish Ministers, the Dundee LEZ scheme will be introduced on 30<sup>th</sup> May 2022. A grace period of two years for both residents and non-residents has been set, meaning that enforcement of the LEZ will not commence until 30<sup>th</sup> May 2024. Work on the installation of the infrastructure required for delivering enforcement will continue during 2022.
- Take forward the other proposed Local Air Quality Management tasks highlighted in Section 6.3.

### **How to Get Involved**

Further information on air quality in Dundee can be found on the website at the following location:

[www.dundee.gov.uk/air-quality/](http://www.dundee.gov.uk/air-quality/) .

Further information on the Dundee LEZ can be found at [www.dundee.gov.uk/LEZ](http://www.dundee.gov.uk/LEZ) .



*The city's first pop-up chargers were installed at the V&A Museum in May 2021. The number of pop-up chargers installed throughout the city totalled 26 during 2021.*



*In total, 41 fully electric vehicles were added to the fleet, including four more fully electric refuse collection vehicles (including 'Sherlock Ohms' (right) operating in the city centre of Dundee)*

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# 1 Local Air Quality Management

This report provides an overview of air quality in Dundee City Council during 2021. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Progress Report (APR) is summarises the work being undertaken by Dundee City Council to improve air quality and any progress that has been made.

**Table 1.1 Summary of Air Quality Objectives in Scotland**

<b>Pollutant</b>	<b>Air Quality Objective Concentration</b>	<b>Air Quality Objective Measured as</b>	<b>Date to be Achieved by</b>
Nitrogen dioxide (NO <sub>2</sub> )	200 µg/m <sup>3</sup> not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
Nitrogen dioxide (NO <sub>2</sub> )	40 µg/m <sup>3</sup>	Annual mean	31.12.2005
Particulate Matter (PM <sub>10</sub> )	50 µg/m <sup>3</sup> , not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
Particulate Matter (PM <sub>10</sub> )	18 µg/m <sup>3</sup>	Annual mean	31.12.2010
Particulate Matter (PM <sub>2.5</sub> )	10 µg/m <sup>3</sup>	Annual mean	31.12.2021
Sulphur dioxide (SO <sub>2</sub> )	350 µg/m <sup>3</sup> , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
Sulphur dioxide (SO <sub>2</sub> )	125 µg/m <sup>3</sup> , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
Sulphur dioxide (SO <sub>2</sub> )	266 µg/m <sup>3</sup> , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005
Benzene	3.25 µg/m <sup>3</sup>	Running annual mean	31.12.2010
1,3 Butadiene	2.25 µg/m <sup>3</sup>	Running annual mean	31.12.2003
Carbon Monoxide	10.0 mg/m <sup>3</sup>	Running 8-Hour mean	31.12.2003

## 2 Actions to Improve Air Quality

### 2.1 Air Quality Management Areas

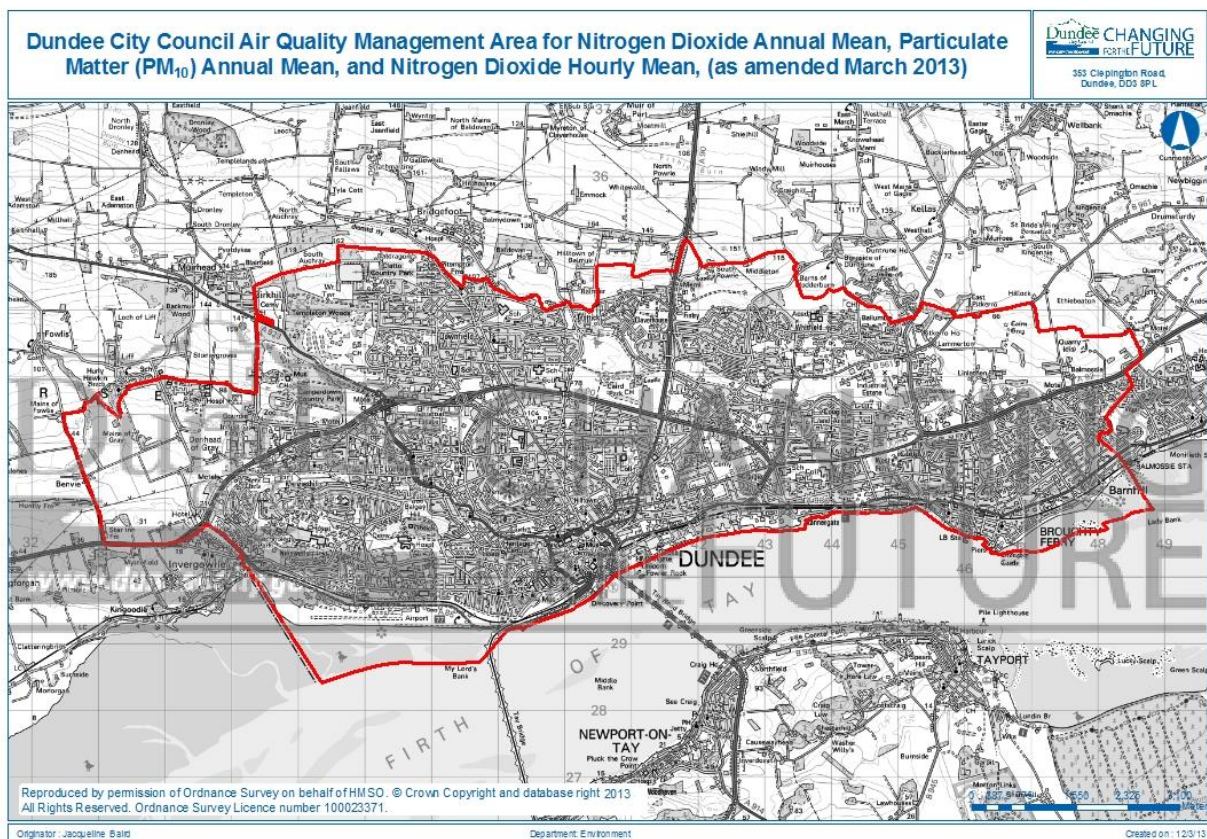
Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12 months, setting out measures it intends to put in place in pursuit of the objectives.

A summary of AQMAs declared by Dundee City Council can be found in Table 2.1, with a map of the AQMA presented in Figure 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at [https://uk-air.defra.gov.uk/aqma/local-authorities?la\\_id=365](https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=365)

**Table 2.1 Declared Air Quality Management Areas**

AQMA Name	Pollutants and Air Quality Objectives	City / Town	Description	Action Plan
Dundee City Council AQMA	NO <sub>2</sub> annual mean  PM <sub>10</sub> annual mean  NO <sub>2</sub> hourly mean	Dundee	The whole of the local government area of the City of Dundee was declared an AQMA in respect of the annual mean objective for NO <sub>2</sub> in July 2006.  In October 2010 the AQMA Order was amended to include the annual mean objective for PM <sub>10</sub> .  The AQMA was further amended in March 2013 to include the hourly mean objective for NO <sub>2</sub> .  See Figure 2.1 for a map of the Dundee AQMA.	Air Quality Action Plan for Nitrogen Dioxide (NO <sub>2</sub> ) and Fine Particulate Matter (PM <sub>10</sub> ) - January 2011  <a href="http://www.dundee.gov.uk/sites/default/files/publications/Dundee%20CC%20FinalAQAP_Jan11.pdf">www.dundee.gov.uk/sites/default/files/publications/Dundee%20CC%20FinalAQAP_Jan11.pdf</a>

Figure 2.1 Dundee Air Quality Management Area map



## 2.2 Cleaner Air for Scotland 2

[Cleaner Air for Scotland 2 – Towards a Better Place for Everyone \(CAFS2\)](#) is Scotland's second air quality strategy. CAFS2 sets out how the Scottish Government and its partner organisations propose to further reduce air pollution to protect human health and fulfil Scotland's legal responsibilities over the period 2021 – 2026. CAFS2 was published in July 2021 and replaces [Cleaner Air for Scotland – The Road to a Healthier Future \(CAFS\)](#), which was published in 2015. CAFS2 aims to achieve the ambitious vision for Scotland "to have the best air quality in Europe". A series of actions across a range of policy areas are outlined, a summary of which is available on the Scottish Government's website.

Progress by Dundee City Council against relevant actions for which local authorities are the lead delivery bodies within this strategy is demonstrated below.

### 2.2.1 Placemaking – Plans and Policies

Local authorities with support from the Scottish Government will assess how effectively air quality is embedded in plans, policies, City Deals and other initiatives, and more generally in cross



departmental working, identifying and addressing evidence, skills, awareness and operational gaps.

Dundee City Council acknowledges the inclusion of this action within the updated CAFS2 air quality strategy and will seek to progress on this action, with support from the Scottish Government, as outlined in the delivery plan that supports the CAFS2 strategy.

### **2.2.2 Transport – Low Emission Zones**

Local authorities working with Transport Scotland and SEPA will look at opportunities to promote zero-carbon city centres within the existing LEZs structure.

Dundee City Council acknowledges the inclusion of this action within the updated CAFS2 air quality strategy and will seek to progress on this action, with support from Transport Scotland, as outlined in the delivery plan that supports the CAFS2 strategy. A detailed explanation of the proposed Dundee LEZ scheme development process follows in section 2.2.3 .

The Dundee Low Emission Zone scheme is to be introduced by the end of May 2022, with a 2-year grace period following before enforcement of the LEZ commences in 2024. During the grace period there will be communications put out by the local authority, in addition to national campaigns to raise people’s awareness of the restrictions on certain vehicle types from being able to drive within the LEZ without penalty. Opportunities to link this with existing zero-carbon initiatives, such as the ‘Drive Dundee Electric’ campaign and ‘Sustainable Dundee’, will be undertaken.

### **2.2.3 Dundee Low Emission Zone scheme**

The development of the Dundee LEZ progressed in line with guidance and requirements outlined in the Scottish Governments 2019 National Low Emission Framework (NLEF) document, the Low Emission Zones (Scotland) Regulations 2021, the Low Emission Zones (Emission Standards, Exemptions and Enforcement) (Scotland) Regulations, the Transport (Scotland) Act 2019 and the 2021 Transport Scotland Low Emission Zone Guidance document.

Due to a cyber-attack on SEPA in late 2020 the scheduled air quality modelling of LEZ scenarios was unable to be carried out in the early months of 2021 as intended. However, an alternative approach was developed and agreed by the LEZ Leadership Group which allowed for local authorities to present evidence lead proposals to their Committees in Spring 2021. The alternative approach included SEPA producing an ‘Emissions Analysis’ report on the traffic modelling outputs from chosen scenarios and assessing the impact of the LEZ by comparing traffic and emissions between the reference/base case and LEZ options.

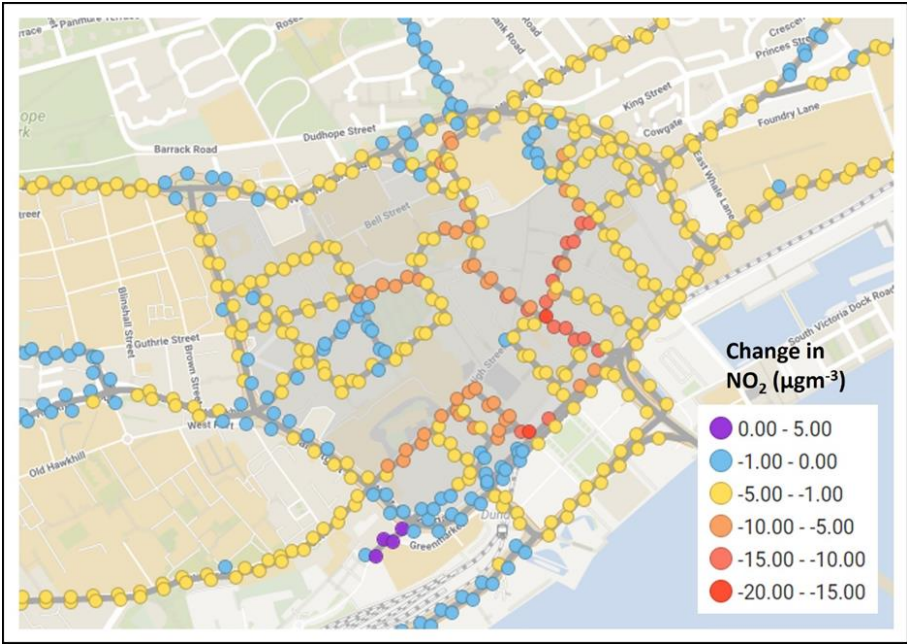
By June 2021 a LEZ scheme had been developed using the SEPA emissions analysis report, traffic modelling outputs and the 2019 consultation exercise, with this proposed scheme being approved by Dundee City Council to be put forward for statutory consultation.

The proposed Dundee LEZ scheme area included most of the area within the A91 inner-ring road network (Figure 2.7), applied to all vehicle types (apart from motorcycles and mopeds) and operates 24 hours a day, 7 days a week all year. The required minimum vehicle emissions standards and vehicle exemptions outlined in the Low Emission Zone (Emissions Standards, Exemptions and Enforcement) (Scotland) Regulations 2021 apply to the Dundee LEZ scheme. Two-year grace periods (during which enforcement of the LEZ will not take place) for both residents and non-residents of the LEZ area and for all non-exempt vehicle types, are proposed meaning enforcement and issuing of penalty notices would not commence until 30th May 2024. The public consultation and stakeholder engagement on the proposed scheme was launched on 14<sup>th</sup> June 2021 and ran for 8-weeks. A total of 148 submissions were received during this period.

SEPA resumed LEZ air quality modelling work in July 2021 however much of the original modelling data for Dundee was not recoverable, causing a delay as some modelling had to be regenerated. In September 2021 the 'Cleaner Air for Scotland – National Modelling Framework Low Emission Zone Dundee Evidence Report' was published by SEPA which provided modelled NO<sub>2</sub> concentrations to support the proposed Dundee Low Emission Zone scheme. The report presented the results of air quality modelling work to examine the changes in emissions and concentrations associated with implementation of the proposed LEZ, including both NO<sub>2</sub> and PM<sub>10</sub>.

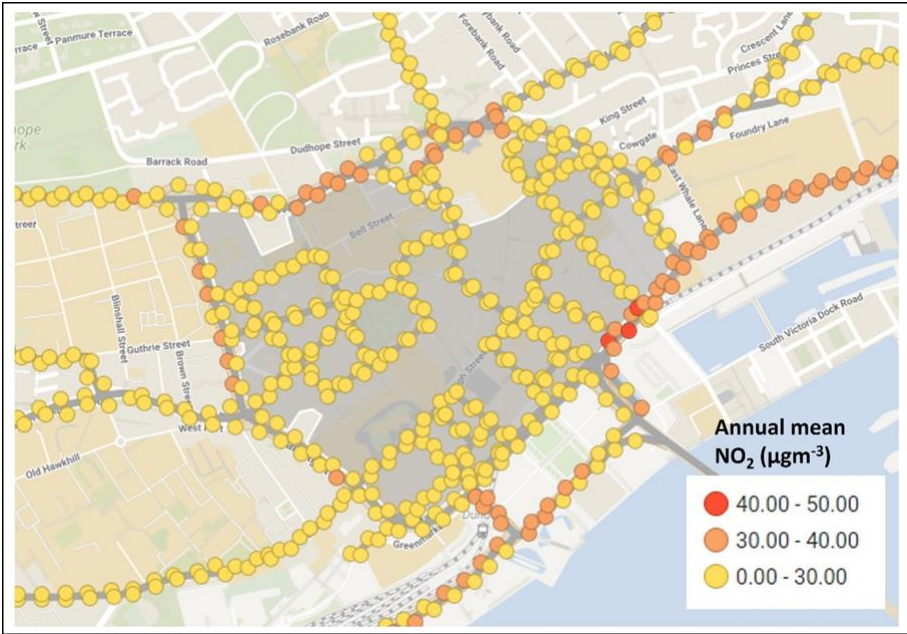
This report outlined that the air quality modelling results indicate that local concentrations of NO<sub>2</sub> within the proposed LEZ area will be reduced by the proposed LEZ scheme (Figure 2.2), and that exceedances modelled inside the LEZ would all be removed following implementation of the LEZ, as shown in Figure 2.3.

**Figure 2.2** Relative change in NO<sub>2</sub> concentration between Reference



The predicted reductions result in roadside NO<sub>2</sub> levels within the LEZ to below the objective level at all locations, as shown in Figure 2.3. Although Figure 2.2 indicates increases along the Greenmarket (purple dots) which is outside of the LEZ area, the level of predicted increase in roadside concentrations is less than 0.5µgm<sup>-3</sup>, corresponding to predicted total NO<sub>2</sub> following implementation of the LEZ of around 25µgm<sup>-3</sup>.

**Figure 2.3** Predicted NO<sub>2</sub> concentration for the LEZ case in the city centre



There are a small number of points outside of the LEZ on Dock Street where there are predicted to be exceedances of NO<sub>2</sub> (Figure 2.3). These exceedances were present in the Reference case of the model and in Diffusion Tube observations. The LEZ is predicted to reduce concentrations on

this road by  $\sim 3\mu\text{g}/\text{m}^3$ , such that the average concentration at roadside points along this section of road exceeds  $40\mu\text{g}/\text{m}^3$  by less than  $1\mu\text{g}/\text{m}^3$  for average traffic speeds. In the more precautionary reduced speed scenario, the average concentration along this section of road exceeds  $42\mu\text{g}/\text{m}^3$ . The SEPA report advises that it is expected that these areas of exceedance on Dock Street will not persist beyond the introduction of the LEZ. SEPA also undertook detailed modelling at façade receptors in this location which indicated that the annual mean  $\text{NO}_2$  concentration does not exceed  $40\mu\text{g}/\text{m}^3$  at any of these receptors.

While improvements are predicted at all monitoring locations, reductions of between  $1.5\mu\text{g}/\text{m}^3$  –  $2\mu\text{g}/\text{m}^3$  are predicted in the region of the automatic monitor and the diffusion tubes on the north west arterial route (NWAR), which includes Lochee Road / Logie Street, that exceeded  $\text{NO}_2$  limit values in 2019 (Figure 2.4). The potential for future  $\text{NO}_2$  exceedances along Lochee Road will depend partly on the extent to which traffic levels return to pre-COVID levels, however separate targeted improvements to the road network in this location are being investigated by Dundee City Council in order to bring about further reductions. This work is ongoing with further traffic analysis due to be undertaken in conjunction with SEPA during March 2022, with possible changes to the road layout / junctions to be analysed within the SEPA air quality model to help identify levels of reductions of  $\text{NO}_2$  concentrations at receptor locations on the NWAR.

**Figure 2.4 Relative change in  $\text{NO}_2$  concentration between Reference and LEZ cases on Lochee Road**



It is also expected that as vehicle fleets change to comply with the LEZ requirements, benefits to air quality will extend beyond the LEZ area, such as Lochee Road (discussed above) where the SEPA report identifies small reductions in  $\text{NO}_2$  concentrations. Figure 2.5 shows predicted

changes to concentrations of NO<sub>2</sub> across the entire model domain, confirming that there are only small changes outside of the inner-ring-road zone.

**Figure 2.5 Relative changes in NO<sub>2</sub> concentration between Reference and LEZ cases across the entire model domain**



The report also includes that the LEZ is also expected to lead to substantial reductions in tailpipe emissions of PM<sub>10</sub>, most notably on bus routes inside the LEZ. However, these emissions have not been used to predict concentrations of PM<sub>10</sub>. Roadside concentrations of PM<sub>10</sub> are dominated by non-tailpipe emissions, including brake and tyre-wear and re-suspension from the road surface. It is difficult to quantify the rates of these 'non-tailpipe' emissions and therefore model predictions of PM<sub>10</sub> concentrations would be associated with high levels of uncertainty.

There are large reductions in PM<sub>10</sub> tailpipe emissions as a result of implementing the LEZ. The largest reductions occur inside the LEZ, as shown by the roads highlighted black in Figure 2.6. This scale of reduction is greater than would be expected to occur in PM<sub>10</sub> concentration data, due to the contribution of non-tailpipe emissions, as discussed above.

**Figure 2.6** Ranked changes in PM<sub>10</sub> emissions (%) on all roads (The greatest reductions occur inside the LEZ as highlighted in black)

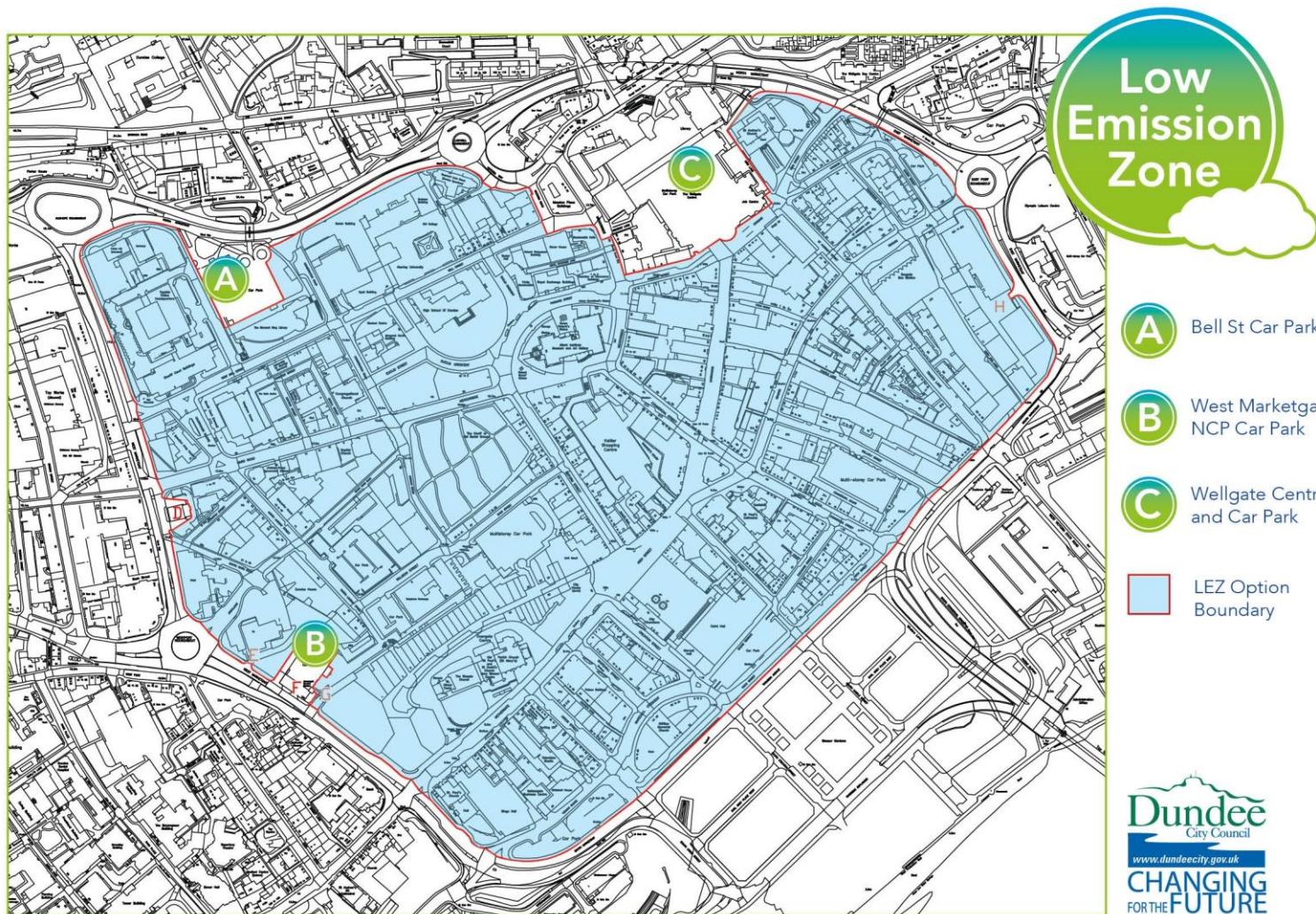


Following consideration of the responses received during the statutory consultation, the Integrated Impact Assessment (IIA) and the SEPA LEZ Evidence report, it was agreed by Committee in October 2021 that there was no need for DCC to reconsider any aspect of the LEZ scheme as included in the proposal consulted upon in June 2021, and therefore it should be the final design and scope of the Dundee LEZ scheme.

As per legislative requirements, a 'Notice of Proposals' for the Dundee LEZ scheme was published which commenced a period during which objections to the proposed scheme could be made. The objection period closed in early 2022 with a total of six objections received. After consideration of the objections no changes to the proposed scheme were considered necessary and as such the statutory process was followed with an application to the Scottish Ministers to make the proposed scheme being submitted in February 2022. This was approved in May 2022 and the LEZ scheme subsequently being introduced on 30<sup>th</sup> May 2022.

Full details of the final Dundee LEZ scheme design are available on the LEZ pages of the DCC website – [www.dundee.gov.uk/lez](http://www.dundee.gov.uk/lez) . The website also contains reports and other documents produced during the LEZ development process, such as the NLEF reports and the SEPA emissions analysis and evidence reports. A map of the LEZ area within DCC is shown in Figure 2.7.

Figure 2.7 Final Dundee Low Emission Zone area map



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## 2.3 Progress and Impacts of Measures to address Air Quality in Dundee City Council

Dundee City Council has taken forward a number of measures during the current reporting year of 2021 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. More detail on these measures can be found in the air quality Action Plan relating to this AQMA.

Key completed measures are:

- There was a 14% increase in the number of members to the Dundee ECO Stars commercial vehicles scheme, with 245 members (8405 vehicles). The number of members of the ECO Stars scheme for taxis/private hire vehicles was maintained at 18 operators (570 vehicles) during 2021.
- Construction of the Active Travel Hub at the Dundee Waterfront was completed in 2021 with this opening to the public in September 2021.
- The Drive Dundee Electric campaign continued to help raise awareness and encourage uptake of low emission vehicles through media publications and at various events throughout the year. Showcase events included events held the lead up to COP26 in November 2021, including the city hosting the 2021 EVI Global Pilot City Forum, in partnership with the International Energy Agency.
- The Dundee City Council Fleet section continued to replace older vehicles with newer, less polluting models. During 2021, 24 diesel vehicles were replaced with electric vehicles. In total, 41 fully electric vehicles were added to the fleet, including four more fully electric refuse collection vehicles. By the end of 2021, there was a total of 171 electric vehicles within the council fleet.
- At the end of 2021 there were 165 pure electric taxis in Dundee, up from 161 in 2020.
- Solar canopies were installed on the salt dome at Marchbanks Depot to provide renewable power for the Heavy Goods Vehicle charging hub installed there. The charging hub at the Olympia multi-story carpark opened to the public in February 2021.
- The city's first pop-up chargers were installed at the V&A Museum in May 2021. The number of pop-up chargers installed throughout the city totalled 26 during 2021.
- 'Clean Air Day 2021' was promoted via social media channels on June 17 to help raise awareness of air quality and how we can protect those most vulnerable to the impacts of exposure to poor air quality.
- A School Streets (vehicle exclusion zone) launched at Fintry PS in September 2021.



- Road infrastructure improvements for Lochee Road at Cleghorn Street / Rankine Street were approved to benefit road safety and to help ease congestion caused by vehicles turning right into these streets from Lochee Road. Other options for alterations along the Lochee Road corridor to ease congestion were progressed with air quality modelling of these to be undertaken in 2022. Bus priority measures were introduced on Meadowside in March 2021.
- A further five docking stations for the Embark electric bike hire scheme were progressed in 2021.
- New segregated cycle lanes were implemented in Perth Road and Ninewells Avenue while sections of the Broughty Ferry cycle route received improvements to lighting during 2021.
- Statutory consultation on the preferred option for the Dundee Low Emission Zone scheme was undertaken in the summer of 2021, with the preferred option then approved for progression as the proposed scheme. The proposed scheme, which included an area within the inner-ring road of the city centre of Dundee and applicable to all vehicles other than motorcycles / mopeds, was then advertised in November and December 2021, with objections to the scheme being accepted during this period. Submission to the Scottish Ministers for approval to introduce the proposed Dundee LEZ scheme would then follow in early 2022.

Progress on the following measures has been slower than expected due to the continuing impact of the pandemic during 2021 on the public transport network and the delayed return to office based working.

- The launch of the Staff Travel Plan has been delayed however is ready to be launched once staff begin returning to the office in 2022.
- The Embark Dundee e-bike hire scheme continues to expand however not all sites earmarked for becoming available during 2021 were so by the end of the year as proposed.
- The commencement of the review and update of the current 2011 Air Quality Action Plan has been delayed however will progress during 2022.

Dundee City Council expects the following measures to be progressed and / or completed over the course of the next reporting year:

- Continuation of both ECOSTARS Schemes for commercial vehicles and Taxis / Private Hire vehicles to encourage engagement with and participation of these transport providers in the achievement of air quality improvements in the city.
- Continued support for Active Travel related projects including the delivery of the School Active Travel Delivery programme and behaviour change campaigns to cycling, active and sustainable travel across the city via joint working with the Dundee Cycle Hub.

- Work will continue with SEPA on the modelling of air quality impacts of road infrastructure improvements on the Lochee Road corridor, with traffic counts being undertaken in March 2022.
- Work will progress on expanding the School Streets (vehicle exclusion scheme) to five more locations in 2022.
- The promotion of Clean Air Day 2022 on 16 June 2022 to help raise awareness of air quality, with this year's theme being *"Air pollution dirties every organ in your body. Take steps to improve your health this Clean Air Day."*
- A project to provide residential cycle storage solutions in areas of Dundee where there is a high level of flatted development and tenements will commence.
- A review and update of the existing 2011 Air Quality Action Plan will progress, aligning changes that have occurred across Dundee since the initial plan was published plus improvements predicted to occur as a result of the LEZ, and action measures contained within the Scottish Governments 'Cleaner Air for Scotland 2 – Towards a Better Place for Everyone' air quality strategy that was published in 2021.
- Following approval by the Scottish Ministers, the Dundee LEZ scheme will be introduced on 30<sup>th</sup> May 2022. A grace period of two years for both residents and non-residents has been set, meaning that enforcement of the LEZ will not commence until 30<sup>th</sup> May 2024. Work on the installation of the infrastructure required for delivering enforcement will continue during 2022.

**Table 2.2 Progress on Measures to Improve Air Quality**

(All previous Annual Progress Reports, Updating and Screening Assessments, and Progress Reports referred to in this table can be accessed at: <https://www.dundee.gov.uk/service-area/neighbourhood-services/community-safety-and-protection/air-quality-in-dundee/air-quality-reports> )

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
1	<b>Measure M1:</b> Existing Road Infrastructure Improvements	Transport, planning and infrastructure	City Centre Improvements - <b>Union Street.</b>	DCC City Development Department (Transportation Division)					<p>Union Street Road Infrastructure improvements were completed December 2011. Two-way traffic was maintained. Pavement widths were altered and the bus stops have been removed to reduce congestion and bus idling. Bus services redistributed to bus stops on Whitehall Street and Nethergate.</p> <p>Union Street between the Nethergate and Whitehall Crescent, was pedestrianised from August 2020. This was put in place and funded through Sustrans Spaces for People with considerations being made to make pedestrianisation permanent.</p> <p>This street is contained within the proposed Dundee LEZ scheme area. The <b>SEPA Low Emissions Zone Dundee Evidence Report September 2021</b> includes that exceedances modelled inside the LEZ area for the base year of 2017 would be removed following LEZ implementation.</p>	Completed 2011	<p>NO<sub>2</sub> concentrations in Union St showed a consistent downward trend to well below the objective from 2010 until monitoring was removed in 2015.</p> <p>All monitoring sites in this area complied with AQO objectives in 2021.</p>
		Transport, planning and infrastructure	North West Arterial Route improvements – <b>Lochee Road</b>	DCC City Development Department (Transportation Division)					<p>Alterations carried out at Lochee Road/Rankine Street in February 2012 removed central reservation to free up road space and reduce congestion.</p> <p>Approval was given in March 2021 to install a central island to prevent drivers from turning right from Cleghorn Street on to Lochee Road, from Lochee Road on to Cleghorn Street, and from Rankine Street on to Lochee Road. Drivers will also not be able to cross Lochee Rd from Rankine Street on to Cleghorn Street or vice-versa. This will have benefits for both road safety and help ease congestion being caused by vehicles looking to make these right-hand turns.</p> <p>Other options for alterations along the Lochee Road corridor to ease congestion were progressed with</p>	Completed 2012  Ongoing	<p>The average long-term trend of annual mean NO<sub>2</sub> at all monitoring locations in Lochee Road is downwards.</p> <p>No exceedances of the hourly NO<sub>2</sub> objective have been recorded since the two exceedances recorded in 2019.</p> <p>All monitoring sites in this area complied with AQO</p>

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
									<p>air quality modelling of potential infrastructure improvements to be undertaken in 2022.</p> <p>Lochee Road is not included within the proposed Dundee LEZ scheme area however a small decrease in NO<sub>2</sub> concentrations is predicted following implementation of the LEZ scheme, including at locations where NO<sub>2</sub> exceedances were observed last in 2019.</p>		objectives in 2021.
		Transport planning and infrastructure	Arterial Route Improvements - <b>Stannergate</b>	DCC City Development Department (Transportation Division)					<p>Consultants engaged in 2013 to carry out traffic micro-simulation modelling and air dispersion modelling.</p> <p>Final draft of the AD Modelling was received in April 2016, with the summary of findings presented in the 2016 Annual Progress Report.</p>	Completed 2016	All monitoring sites in this area complied with AQO objectives in 2021.
		Transport planning and infrastructure	City Centre Improvements - <b>Meadowside</b>	DCC City Development Department (Transportation Division)					<p>Meadowside – in 2012 a trial lane closure at the north end of street to increase separation distance between traffic and receptors was put in place. A temporary paving surface was introduced in October 2013 to allow the impact on monitored concentrations to be studied for a 12month period. Permanent street infrastructure changes were completed in Feb/March 2016.</p> <p>Bus priority measures were introduced on Meadowside in March 2021. The measures remove general traffic(cars etc) going north bound at the Meadowside signals near the Wellgate centre, with traffic diverted onto Bell Street from Meadowside to join at Victoria Street west of the Meadowside signals.</p> <p>This street is contained within the proposed Dundee LEZ scheme area. The <b>SEPA Low Emissions Zone Dundee Evidence Report September 2021</b> includes that exceedances modelled inside the LEZ area for the base year of 2017 would be removed following LEZ implementation.</p>	Completed 2016	<p>The monitoring results since 2015 demonstrate that the air quality improvements attributable to this infrastructure change have been maintained.</p> <p>All monitoring sites in this area complied with AQO objectives in 2021.</p>
		Transport planning and infrastructure	City Centre Upgrade 13 traffic signals with fibre optic connections	DCC City Development Department (Transportation Division)					A Fibre network was implemented to improve Traffic Signals communication (and revenue saving) with the Control Room in Dundee House. This network will improve reliability and efficiency of Urban Traffic Management and Control (UTC)	Completed 2019	

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
		Transport planning and infrastructure	City Centre Improvements – <b>Seagate / St. Andrews Street</b>	DCC City Development Department (Transportation Division)					<p>In late 2014, consultants were commissioned to undertake a review of transport activity on the Seagate with a specific focus on identifying actions that would address its poor air quality. The report concluded that there were no affordable actions that could ensure AQ thresholds were met, but a range of actions could help reduce emissions. Air Dispersion modelling demonstrated that if all buses and HDVs were Euro VI then no exceedances of the NO<sub>2</sub> or PM<sub>10</sub> objectives would persist in the city centre.</p> <p>Traffic modelling undertaken by SYSTRA with 2016/17 funding showed that the proposed transport management options would be unacceptable on traffic congestion, access and air quality grounds.</p> <p>This street is contained within the proposed Dundee LEZ scheme area. The <b>SEPA Low Emissions Zone Dundee Evidence Report September 2021</b> includes that exceedances modelled inside the LEZ area for the base year of 2017 would be removed following LEZ implementation.</p>	Completed 2017	All monitoring sites in this area complied with AQO objectives in 2021.
		Transport planning and infrastructure	City Centre Improvements – <b>Crichton Street / Whitehall Street / Nethergate</b>	DCC City Development Department (Transportation Division)					Consultants were commissioned in March 2017 to examine the current bus movements through the city centre. The executive summary of this report is in <b>Appendix C.5</b> of the 2018 DCC Annual Progress Report.	Completed 2017	
2	<b>Measure M2:</b> DCC will enhance the Urban Traffic Management and Control (UTMC) system to reduce congestion	Traffic management	Real-time traffic monitoring. Improved control regime to smooth out peak traffic.	DCC City Development Department (Transportation Division)	Implementation of UTMC improvements and carry out annual review to measure % reduction in congestion in line with target				<p>UTMC scheme was implemented in March 2013 to expand UTMC to two congested junctions in Lochee Rd AQ hotspots.</p> <p>Seagate / Commercial Street traffic light refurbishment to improve bus and traffic flows completed Feb 2013. Coupled with increased enforcement of waiting restrictions to reduce congestion.</p> <p>TACTRAN funding provided in 2014/15 to expand Bluetooth Traffic Speed Monitoring System to include the Lochee Road. The system was expanded along the eastern corridor on the A92 coming in from Arbroath and Broughty Ferry. Bluetooth journey time monitoring is now undertaken on all</p>	Completed 2013  Completed 2016	

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
									major arterial routes leading in to the city centre area.		
			Paramics/ AIRE modelling of key junctions – Kingsway / Forfar Rd & Lochee Rd corridor to test improvement options	DCC City Development Department (Transportation Division)					Consultants were engaged in 2013 to carry out traffic micro-simulation modelling and air dispersion modelling. A detailed summary of the options is contained in <b>Appendix C</b> of the 2016 Annual Progress Report.	Completed 2016	
3	<b>Measure M3:</b> DCC to identify partnership and funding to continue benefits of Smarter Choices/Smarter Places: Dundee Travel Active Programme	Promoting travel alternatives	Identify and implement wider partnership to continue programme. Identify funding.	DCC City Development Department (Transportation Division)					Embark Dundee – Electric bike hire Scheme launched in December 2020 with 14 docking stations and roughly 130 e-bikes. Five new docking stations were progressed in 2021, while promotional work was taken forward to increase ridership.  The Dundee Cycle Hub (DCH) opened in September 2021. This improves the potential for DCC to work the DCH staff to develop partnership working across the third sector to promote active travel initiatives.  The DCC City Development service developed its relationship with the UNESCO City of Design team to ensure community co-design is integral to future place-making projects such as those delivered in in Stobswell and Hilltown during 2021.	ongoing	
		Promoting travel alternatives	Behavioural Change Primary School programme to promote sustainable travel options in all primary schools	DCC City Development Department (Transportation Division)					The Active Travel Schools team continued to work with primary and secondary schools in Dundee through 2021 with a particular focus on supporting walking and cycling to school.  A School Streets (vehicle exclusion zone) launched at Fintry PS in September 2021. Approval was given to expand School Streets to five more locations in 2022.	ongoing	
4	<b>Measure M4:</b> DCC will introduce measures to improve bus services and reduce emissions	Transport planning and infrastructure	Statutory Bus Quality Partnership. Voluntary Bus Quality Partnership	DCC City Development Department (Transportation Division)					The Tayside Bus Alliance was established in 2020 to develop a joint submission to the Scottish Government's Bus Partnership Fund. Dundee City Council is a member of this. The alliance has helped lay some foundations for a future Bus Service Improvement Partnership in Dundee.  The Tayside Bus Alliance secured an initial funding allocation of £497k from Transport Scotland's Bus Partnership Fund and will now	ongoing	

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
									undertake feasibility work on multiple bus corridors across Dundee.		
		Vehicle Fleet efficiency	Fleet Renewal – Emissions Improvements	DCC City Development Department (Transportation Division)					Major bus companies in Dundee have been successful in applying for funding for retrofitting buses to EURO VI equivalence through the four phases of the Bus Emissions Abatement Retrofit (BEAR) programme.  Xplore Dundee launched 12 new Zero-Emission electric buses in December 2021 and these will operate on the Service 28 route which serves the Lochee Road. Buses that had been retrofitted with cleaner engines in 2019 were moved to other routes ensuring the previous investment continued to have a positive effect on air quality in the city.	ongoing	
		Vehicle Fleet efficiency	ECO Stars Dundee Fleet Management Recognition Scheme introduced						See measure 6	ongoing	
5	<b>Measure M5:</b> DCC will explore provision of Park and Ride facilities that do not have adverse impact on air quality	Alternatives to private vehicle use	Provision of Park and Ride (P&R) facilities	DCC City Development Department (Transportation Division) & Tayside and Central Scotland Transport Partnership (TACTRAN)					The Southern Park & Ride project is being led by Tactran, SEStrana and Fife Council. Dundee City Council supports this project which is proposed to be located to the south of the Tay Road Bridge.	ongoing	
6	<b>Measure M6:</b> DCC will introduce measures to reduce emissions from Heavy Goods Vehicles	Freight and delivery management	ECO Stars Dundee Fleet Management Recognition Scheme being introduced in 2013  Funding to continue the scheme will be applied for on an annual basis through the AQAP grant scheme.						Dundee City Council received funding from the Scottish Government's Air Quality Support Funding to enable continuation of the ECO Stars scheme for larger commercial vehicles and the separate scheme for Taxis and Private Hire Vehicles during 2021.  30 new members, bringing 612 new vehicles, joined the Dundee commercial fleet scheme in 2021. This increased number of members to 245 (8405 vehicles) by the end of 2021.	ongoing	
7	<b>Measure M7:</b> DCC will seek improvements in emissions standards, including NO <sub>2</sub> and PM <sub>10</sub> for the council fleet and public service vehicles	Promoting Low Emission Transport	Development of Green Procurement Strategy To set target for Euro category/fuel type	DCC City Development Department (Transportation Division)					See also measure 14.  The Fleet Section within Dundee City Council continues to replace older vehicles with newer, less polluting models. In 2021, 24 diesel vehicles were replaced with electric vehicles.  In total, 41 fully electric vehicles were added to the fleet. This	ongoing	

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
									included four more refuse collection vehicles as well as cars and vans.  By the end of 2021, there was a total of 171 electric vehicles within the council fleet.		
		Vehicle Fleet Efficiency	Participation in ECO Stars Dundee-Fleet Management Recognition Scheme	DCC City Development Department (Transportation Division)					DCC Fleet continue to further the work done to achieve a 4-star rating in the ECO stars Recognition Scheme.	ongoing	
8	<b>Measure M8:</b> DCC in consultation with the Taxi Liaison Group will explore means of reducing emissions from taxis and private car hire vehicles in AQMA	Promoting low emission transport	Enforce No idling for taxis. Increase cleaner taxis.						At the end of 2021 there were 165 pure electric taxis in Dundee, up from 161 in 2020.		
		Vehicle Fleet Efficiency	Explore the potential of introducing Licensing Conditions for minimum taxi Euro category for certain classes of vehicles;						In 2015 DCC introduced a condition within the school transport contracts requiring any successful applicant to become a member of the ECOSTARS Scheme for Taxi Operators by July 2016.  DCC continues to implement a policy first introduced in 2016 that any applications for new Taxi Licences & Private Hire Car would only be granted on the condition that only an electric vehicle from the approved list can be placed on service.	ongoing	
		Vehicle Fleet Efficiency	Expansion of ECOSTARS to include taxi / private hire operators						Funding to expand ECO Stars in Dundee to include taxi and private hire vehicle operators was obtained in 2014/15, with the scheme formally launched on the 11 <sup>th</sup> March 2015.  The number of members of the ECO Stars Dundee taxis/private hire vehicles scheme remained at 18 during 2021. There was a slight reduction to the number of vehicles, with this figure being 570 at the end of 2021.	ongoing	
9	<b>Measure M9:</b> DCC will investigate to initiate a Roadside Emission Testing (RET) scheme inside the AQMA	Traffic Management	To investigate into the establishment of a programme of RET in the AQMA						Not progressed during 2021.		



Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
	and routes leading to AQMA										
10	<b>Measure M10:</b> DCC will ensure local air quality is fully integrated into the Local Development Plan (LDP) process and development scenarios are appropriately assessed with respect to the potential impacts on air quality	Policy Guidance And Development Control	Provide AQ policy within Local Development Plan with commitment to improve air quality Produce air quality Supplementary Planning Guidance (SPG)	DCC City Development (Planning Division)  DCC Environment Department.					The 2019 Local Development Plan was adopted in February 2019. Along with this Plan the Supplementary Guidance Air Quality & Land Use Planning document was also adopted.	2019	
11	<b>Measure M11:</b> DCC will ensure effective co-ordination between climate change and air quality strategies and action plan measures	Policy Guidance And Development Control	Strategy to be developed to improve co-ordination between climate change and air quality strategies and action plan measures	DCC Corporate Planning Department DCC City Development - (Property Division) DCC Environment Department					<p>The Sustainability &amp; Climate Change Manager sits on the Corporate Air Quality Steering Group and also the Dundee Low Emission Zone Delivery Group to ensure synergy between AQ and CC policy.</p> <p>Dundee City Council declared a climate emergency in June 2019 and have worked through the Dundee Partnership to develop and deliver a citywide Climate Action Plan in support of the transition to a net-zero and climate resilient future. In line with Scottish Government and Council objectives for CAFS, tackling air quality and decarbonising transport are key objectives of this plan. Of the 62 actions in the plan, 18 are related to air quality.</p> <p>In order to increase the pace of collaborative action and co-ordination across sectors, the Dundee Climate Leadership Group was established in 2021. This high-level group provides active leadership on Dundee's net-zero challenge, leveraging expertise from across the city in order to engage and inspire collective ownership and a shared commitment to tackling climate change. The group is supported by the newly formed, Sustainable Dundee Network, established as a legacy to Dundee's COP26 events programme and is tasked with coordinating and collaborating on public engagement, events and projects that build on the Dundee Climate Action Plan.</p>	ongoing	

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
12	<b>Measure M12:</b> DCC will continue its active involvement and support of TACTRAN	Policy Guidance And Development Control	Regularly attend meetings Provide feedback Provide necessary support						The Council will continue to support TACTRAN and focus on implementation of Regional Transport Strategy throughout the period of this plan. TACTRAN are included in the Dundee LEZ Delivery Group.	ongoing	
13	<b>Measure M13:</b> DCC will promote the uptake and use of cleaner and/or alternative fuels where possible for transport  DCC will explore the development of electric charging point infrastructure	Promoting low emission transport	Determine strategy/advise note and annually review content  Install Electric Charging Facilities in Car Parks						See also measures 7 and 14  The <u>Drive Dundee Electric</u> campaign continued its successful engagement with current and potential electric vehicle (EV) owners (both in public and business) through the local media in the form of EV related articles encouraging people to make the switch to EV.  In early 2021, two fully electric HGVs were added to the DCC fleet. An additional 4 HGVs were then introduced in June.  Olympia multi-storey charging hub was opened to the public in February 2021.  In May 2021, the city's first pop-up chargers were installed at the V&A Museum. This then extended to 26 pop-up chargers throughout the city during 2021.  As part of COP26, Dundee City Council hosted the 2021 EVI Global Pilot City Forum, in partnership with the International Energy Agency.  Solar canopies were installed on the salt dome at Marchbanks Depot to provide renewable power for the electric HGVs that are stored at this site.	ongoing	
14	<b>Measure M14:</b> DCC will establish and implement a rolling programme for replacing older more polluting vehicles with newer cleaner vehicles, which comply with the prevailing EURO standard	Vehicle Fleet Efficiency	Development of Green Procurement Strategy						See also Measure 7.  By the end of 2021, the Fleet Section within Dundee City Council had replaced 24 older diesel vehicles with newer electric models during the year. In total, there were 171 fully electric vehicles within the DCC fleet by the end of 2021.	ongoing	
15	<b>Measure M15:</b> DCC will improve the Council's vehicle fuel	Vehicle Fleet Efficiency	Develop fleet management plan to improve fuel efficiency.						See also Measures 7, 13 and 14.  The Council continue to fit vehicles with GIS route optimisation	ongoing	

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
	consumption efficiency by better management of fleet activities								software to effectively manage vehicle mileage.		
16	<b>Measure M16:</b> DCC will promote options for better travel planning amongst Dundee City Council employees	Promoting Travel Alternatives	Review DCC Travel Plan  DCC to investigate use of annual survey on how/what modes of transport employees use to travel to work	DCC City Development (Transportation Division)					See also Measures 3, 17 & 22.  A Staff travel survey was completed in October 2019, with over 700 responses were received. A draft Staff Travel Plan was created, with the proposed 2020 launch postponed due to the impact of the pandemic. It remains ready to be launched when staff begin to return to offices via a hybrid approach in 2022.  During COP26 in November 2021, all DCC staff were presented with internal messaging via MyDundee (the Council's intranet site) around active travel. Messages were shared using Sway presentations, one specifically focussed on sustainable travel, showing local availability, educating about the benefits to health and well-being and the travel hierarchy, putting active travel first. Following on from this, mandatory all staff Climate Literacy Training reiterated the importance of personal action and active travel.	2021	
17	<b>Measure M17:</b> DCC will continue to promote and encourage their employees to consider the use of bicycles in their daily duties by providing cycle usage mileage	Promoting Travel Alternatives	Continue to investigate and develop the use of various incentive schemes  Develop cycling strategies  DCC to investigate use of annual survey on how/what modes of transport employees use to travel to work						See also Measures 3, 16 & 22.  An updated Dundee Cycling Strategy was launched in September 2019. This refresh of the 2016 strategy sets out how Dundee City Council will deliver its duties, powers and policies to enable and encourage more people to cycle more often.  Dundee City Council progressed actions contained within the 2019 Dundee Cycling Strategy to enable and encourage more people to cycle more often.  Agreement has been reached with Embark Dundee, the electric bike hire scheme, to enable corporate DCC membership of the public e-bike hire scheme.	ongoing	
18	<b>Measure M18:</b> DCC will assess the Council's energy needs, make recommendations	Policy Guidance And Development Control	DCC to implement annual energy reduction action plan						The Council continues to invest in a range of energy management projects within its non-domestic building estate. Physical improvements to building fabric, installation of energy efficiency	ongoing	

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
	and implement reductions of carbon emissions which result in corresponding reductions of NO <sub>2</sub> and PM <sub>10</sub> .								<p>measures and behavioural change campaigns have led to year-on-year reductions in carbon emissions from the Council's buildings. The organisation's carbon footprint has reduced by 49% since 2007/08 and reduced by 11% in last reporting year to 2020/21.</p> <p>The Council also continues its substantial investment in decarbonising its own fleet of vehicles and business travel footprint with Dundee recognised world-wide as a leading city in the introduction and support of electric vehicles. The Council has 170 electric vehicles in its own fleet, more than any other local authority in the UK as well as 6 Electric Refuse Vehicles each named by the public, including "Bin Diesel" and "Leonardo Di Chaggio". By making this switch 20,000kg of carbon dioxide (CO<sub>2</sub>) being saved – per vehicle. The long-term plan is to convert all DCC vehicles to full electric by 2035. Once all 36 refuse collection vehicles are converted to electric, this will equate to 720,000kg of CO<sub>2</sub> being saving.</p> <p>Since 2010 the Council has worked in partnership to deliver first class electric vehicle charging infrastructure resulting in Dundee now having in excess of 310 EV charge points installed, three solar canopy and battery storage hubs and innovative pop-up chargers.</p>		
19	<b>Measure M19:</b> DCC to promote and support localised energy generation that doesn't compromise Air Quality in private households	Promoting Low Emission Plant	Determine strategy/advise note and annually review content	DCC Housing Department Solar Cities					<p>Non-Domestic Energy Efficiency - Basket 2 project is complete with verified annual savings of £270,000 / 730 tCO<sub>2</sub>.</p> <p>Non Domestic Energy Efficiency - Basket 3 project (known as Climate Action Property Energy Conservation Programme) is due to start in the autumn 2021/22 with projected annual savings of £260,000 / 650tCO<sub>2</sub>.</p> <p>Feasibility projects to determine the suitability of Photovoltaic installations to several properties are complete and currently being considered.</p>		
20	<b>Measure M20:</b> DCC will provide the public with relevant air	Public Information	Investigating the potential for uptake of an air pollution information system, such as Air Alert	DCC Environment Department  DCC City					The 2021 Annual Progress Report was submitted in June 2021 and is able to be download through the Dundee City Council website.	ongoing	

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
	quality information.		Improvements to AQ website information  Make up to date air quality information available to the public through Councils digital website	Development (Transportation Division)					Historical air quality monitoring data for the 2006 – 2015 period is also directly available through the DCC website. The DCC website also contains links to real-time and historical air pollutant data from Dundee's continuous automated monitors presented on the Scottish Air Quality (SAQ) website.  The Dundee Low Emission Zone webpage ( <a href="http://www.dundee.gov.uk/LEZ">www.dundee.gov.uk/LEZ</a> ) contains detailed reports created during the process to identify the preferred scheme for Dundee's LEZ, including air quality evidence reports created by SEPA using outputs from the National Modelling Framework (NMF) AQ City Model and Paramics Traffic modelling.		
21	<b>Measure M21:</b> DCC will continue its work to increase uptake and implementation of School and Workplace Travel Plans, particularly where likely to impact on the AQMA	Promoting Travel Alternatives	DCC to ensure all relevant commercial planning applications have travel plan conditions applied in accordance with current best practice.	DCC City Development Department, (Planning Division, Transportation Division)  DCC Education Department					School Travel Plans are discussed at the School Travel and Pupil Safety Working Group with commitment from Executive Director of Children & Families Service to support schools in developing their own travel plans.		
22	<b>Measure M22:</b> DCC will continue working in partnerships with TACTRAN and local active travel networks to ensure that walking and cycling initiatives are promoted and supported in Dundee	Promoting Travel Alternatives	Identify walking & cycling schemes (such as Park & Cycle).  Identify walking & cycling promotional opportunities around Dundee City	DCC City Development (Transportation Division)					See also Measures 3, 16 & 17.  DCC continues to participate in all TACTRAN meetings focused on active and sustainable travel developments and works in partnership.  The Dundee Cycle Hub was opened in September 2021 and sections of the Broughty Ferry cycle route were improved during 2021, including improved lighting.  More Spaces for People projects were delivered in 2021 including placemaking at Eliza Street and Craiggie Street and footway widening in the Hilltown.  New segregated cycle lanes were implemented in Perth Road and Ninewells Avenue.	ongoing	
23	<b>Measure M23:</b> DCC will continue to work with transport providers to	Transport planning and infrastructure	Promote schemes such as the SQUID card including Dundee and surrounding towns.						The continuing impact of the pandemic has meant that promotional work to increase bus ridership was restricted while public health messaging focused on	ongoing	

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
	support and promote increased uptake of public transport modes		Introduce smart and integrated ticketing						<p>essential travel only though much of 2021.</p> <p>The bus operators have continued to provide services to those requiring to travel throughout this difficult operating period (with financial support from the Scottish Government) but 2021 did see a contraction of the city's commercial network. DCC was able to fill some of these gaps with its tendered network of supported services that commenced in August 2021.</p> <p>Work will be required in 2022 to encourage passengers back to bus and there will be a focus on improving public transport information.</p>		
24	<b>Measure M24:</b> DCC will continue to work in partnership with other organisations to promote and implement energy efficiency measures in Dundee	Policy Guidance and Development Control	To implement an Annual Action Plan of energy efficiency measures.	DCC City Development (Property Division)					<p>The Council has invested approximately £47m in its External Wall Insulation programme with almost 5,000 residents in Dundee seeing their properties thermally upgraded. These improvements played a significant part in creating warmer homes with reduced fuel bills for residents as well as tackling fuel poverty across the city which, up until the current energy and cost of living crisis, continued to experience a downward trend.</p> <p>The Council has completed its second phase of installation of energy conservation measures within its own estate using an Energy Performance Contracting model. In total £4.4 million has been spent on 26 sites with guaranteed energy savings of around £500,000 per annum. This has resulted in annual savings of 1,800 tonnes of CO2. Measures have included LED Lighting, more efficient hardware/software (motors, boiler burners, control of pumps), Combined Heat and Power, insulation, solar PV etc.</p>	ongoing	
25	<b>Measure M25:</b> DCC Environment Department will comment upon planning applications to ensure that all relevant air quality issues are highlighted and mitigation	Policy Guidance and Development Control	The Environment Protection section will continue to work with City Development (Planning Division) as Statutory Consultees	DCC City Development Department (Planning Division)  DCC Environment Department			Total number of planning applications consultations responded to in each calendar year (changed from financial year)		Officers from the pollution team within Community Safety and Protection check weekly planning lists and provide comments to the Planning Officers on all applications which may adversely impact on local air quality. 35 planning applications were responded to for the 2021 calendar year.	ongoing	

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
	measures are considered wherever possible										
26	<b>Measure M26:</b> DCC will enforce statutory legislation to control smoke, dust, fumes or gas emissions from commercial and domestic premises which are causing a nuisance or are prejudicial to health	N/A	DCC will continue to monitor and enforce statutory legislation in this area	DCC Environment Department			Number of relevant complaints in each financial year. % resolved		For the period 1 <sup>st</sup> January to 31 <sup>st</sup> December 2021, officers investigated a total of 15 relevant complaints of which 13 (87 %) had been resolved, with 2 still being investigated.	ongoing	
27	<b>Measure M27:</b> DCC will enforce relevant legislation to reduce the burning of commercial and domestic waste	N/A	DCC will continue to monitor and enforce legislation in this area	DCC Environment Department			Number of relevant complaints in each financial year. % resolved		During 2021, officers investigated 11 complaints of smoke from commercial waste burning, which were all resolved, and 44 complaints from domestic waste burning (bonfires), with 2 still being investigated.	ongoing	
28	<b>Measure M28:</b> DCC will promote composting in a bid to reduce pollution from domestic bonfires	Policy Guidance and Development Control	Reintroduce discount / promotion campaign for compost bins	DCC Environment Department					In March 2020 a charge was introduced for the collection of garden waste. Householders who decided not to sign up were provided with different options for disposal of garden waste and discouraged from using the general waste bin or burning waste.  DCC continued to offer a home composting bin as an alternative to the annual garden waste collection permit.	ongoing	
29	<b>Measure M29:</b> DCC will continue to monitor a range of air pollutants throughout Dundee and make the monitoring information freely available to the public in an easily understandable form	Public Information	Continued support for Dundee Air Quality Monitoring Network	DCC Environment Department					See <b>Chapter 3</b> of this report for details of the automatic and non-automatic monitoring locations in Dundee.  The existing NO <sub>2</sub> monitor within the Mains Loan automated monitoring station, which is part of the AURN monitoring network, was replaced in September 2021 due to having reached its age limit.  See <b>Measure 20</b> re availability of air quality monitoring data on both the Dundee City Council and Scottish Air Quality websites, and the 2021 Annual Progress Report being available for viewing and download via the DCC website.	ongoing	
30	<b>Measure M30:</b> DCC will ensure that all air quality	Public Information	Regular calibrations and filter changing of	DCC Environment Department					See <b>Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC</b>	ongoing	

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
	monitoring data reported to the public is both accurate and precise by implementing quality control measures		continuous monitoring equipment in DCC's air quality stations  At least annual audit of air quality stations' equipment  Appropriate use and care of NO <sub>2</sub> diffusion tubes regularly deployed around the City Council area.						of main report for details of processes.  All diffusion tube changeovers were in accordance with the 2021 diffusion tube calendar.		
31	<b>Measure M31:</b> DCC will establish additional monitoring sites across the City in locations where poor air quality is suspected	N/A	DCC will continue to carry out and report on their statutory duties under the Review & Assessment process for LAQM	DCC Environment Department			Poor air quality sites identified monitored and dealt with through the process of Review & Assessment.  Additional monitoring sites established as and when required		See Measure 29 regarding pollutant monitoring locations.  No new diffusion tube monitoring locations commenced in 2021 due to decision that locations introduced in January 2020 (Cleington Road / Mains Loan, Dock Street (Customs House), Dock Street / Gellatly Street, and Victoria Street (Eagle Mill)) should remain due to the impact of pandemic lockdown restrictions on 2020 levels, while no existing location should be removed for the same reason. See <b>Chapter 3</b> of this report for further details.	ongoing	See Section 3.1.2., Table A.3 and Appendix B of the main report for monitoring results for the diffusion tube locations in 2021.
32	<b>Measure M32:</b> DCC will implement road traffic counts to inform the review and assessment process.	Traffic Management	Undertake classified traffic counts	DCC Environment Department					There were no traffic counts undertaken specifically for air quality purposes during 2021.  Annual road count data (as AADT) from the council's long-term Road Traffic Reduction Act (RTRA) Sites from 2005-2021 is presented in <b>Appendix E</b> of the main report.	ongoing	



## 3 Air Quality Monitoring Data and Comparison with Air Quality Objectives

### Summary of Monitoring Undertaken

#### 3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how local concentrations of the main air pollutants compare with the objectives.

Dundee City Council undertook automatic (continuous) monitoring at 10 sites during 2021. Table A.1 in Appendix A shows the details of the sites. There are currently three different PM<sub>10</sub> monitors (CM3, CM13, CM16) co-located at the Broughty Ferry Road site to help improve data accuracy and validity. On 1<sup>st</sup> March 2021 the NO<sub>x</sub> analyser at the Meadowside monitoring station was replaced allowing monitoring for this pollutant to recommence after it had stopped in June 2020 due to an unrepairable fault with the analyser. On 21<sup>st</sup> September 2021 Defra upgraded the existing NO<sub>x</sub> analyser at the AURN affiliated site at Mains Loan.

National monitoring results are available at [www.scottishairquality.co.uk](http://www.scottishairquality.co.uk). Further analysis of this monitoring is also available on the Air Quality in Scotland website within an annual summary report for Dundee City prepared by Ricardo Energy & Environment - [https://www.scottishairquality.scot/assets/reports/365/Dundee\\_City\\_annual\\_2021.html](https://www.scottishairquality.scot/assets/reports/365/Dundee_City_annual_2021.html).

Maps showing the location of the monitoring sites are provided in [Appendix A](#). Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

#### 3.1.2 Non-Automatic Monitoring Sites

Dundee City Council undertook non-automatic (passive) monitoring of NO<sub>2</sub> at 88 sites during 2021. Table A.2 in Appendix A shows the details of the sites.

Maps showing the location of the monitoring sites are provided in Appendix A. Further details on Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in Appendix C.

Owing to the impact of the 2020 lockdown measures on pollutant levels, in particular NO<sub>x</sub> emissions as a result of the reduced road traffic, it was decided that no tube locations would be removed or new locations added, maintaining the same tube locations from 2020 through to 2021.

#### 3.1.3 Other Monitoring Activities

##### 3.1.3.1 Vehicle Emissions Remote Sensing – real-world emissions measurements

Utilising Air Quality Funding awarded by the Scottish Government in 2020, Dundee City Council commissioned Ricardo Energy & Environment to carry out remote sensing of real-world emissions,

and to produce a subsequent report presenting analysis of the real-world emissions measurements from vehicles in two locations in Dundee.

The remote sensing equipment was deployed over a period of 8 days during April and May 2021, with the measurement locations being on:

- Blackscroft, after the junction with Dens Street
- Lochee Road, near the junction with Black Street

Over 29,000 vehicle measurements were made over the course of the measurement campaigns, including over 23,000 cars, 4,162 LGVs, 349 HGVs and 477 buses. The remote sensing measurements are local to the area, and therefore the emissions are representative of the actual vehicle fleet in the local area. Vehicle information such as vehicle type, age, mileage, makes and models are gained.

The report presents an analysis of the real-world emissions measurements made during measurement campaigns conducted in Dundee. Content within the report covers aspects such as the fleet composition by location, real-world emissions of NO<sub>x</sub> and PM, analysis of hybrid vehicles, NO<sub>x</sub> emission factors, and how real-world emission factors can be combined with local fleet data to provide source apportionment for specific roads. The following Figures 3.1 to 3.3 provide examples of information presented in the report.

**Figure 3.1 Real World Monitoring Fleet Composition**

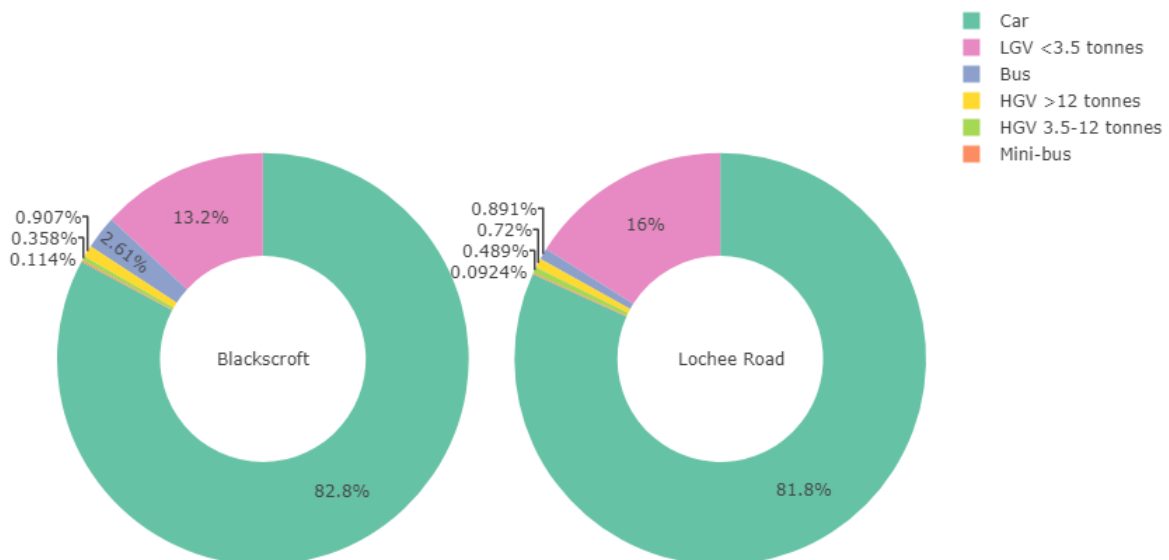


Figure 3.2 Real World Monitoring Car & LGV Fleet by fuel type and Euro Standard

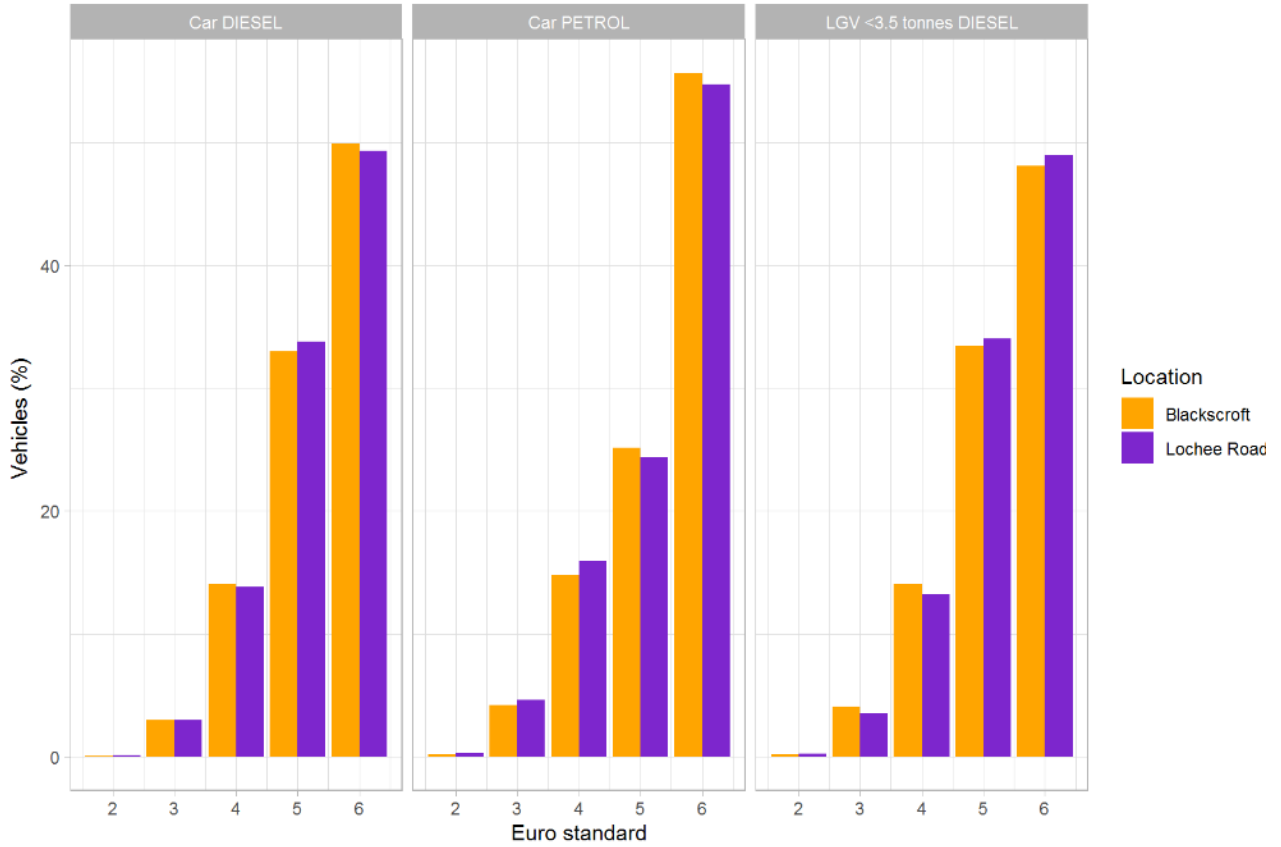
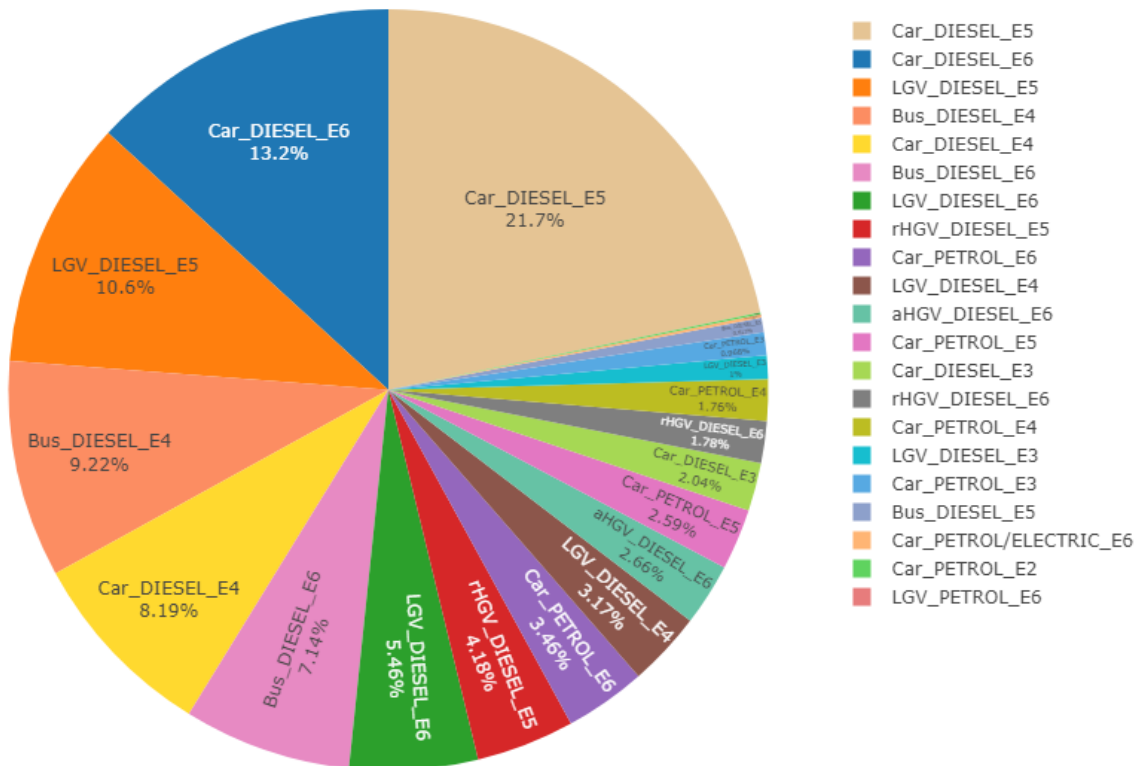


Figure 3.3 Real World Emission apportionment of emissions - Blackscroft



Euro 5 diesel cars, Euro 5 diesel LGVs and Euro 6 diesel cars are the top three emissions sources at each of the measurement locations. The other highest sources include Euro 4 diesel cars, Euro IV and Euro VI diesel buses (on Blackscroft) and Euro 6 diesel LGVs. Emissions on both roads are dominated by diesel vehicles.

The proposed use of this information is to assist with the development of the Dundee Low Emission Zone scheme, and for the review and update of the existing 2011 Dundee Air Quality Action Plan that is proposed to be carried out during 2022 and 2023.

## Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for annualisation and bias. Further details on adjustments are provided in Appendix C.

### 3.1.4 Nitrogen Dioxide (NO<sub>2</sub>)

Table A.3 in Appendix A compares the ratified and adjusted monitored NO<sub>2</sub> annual mean concentrations for the past five years with the air quality objective of 40 µg/m<sup>3</sup>.

The full 2021 dataset of monthly mean values of the NO<sub>2</sub> passive diffusion tubes is provided in Appendix B.

The procedure specified in paragraphs 7.77 to 7.79 of statutory technical guidance LAQM.TG (16) was used to estimate the concentrations at the nearest receptor.

The annual mean background concentration used in the calculation was 13.8 µg/m<sup>3</sup> (from DT 185) for city centre sites, and 12.3 µg/m<sup>3</sup>, the average of concentrations from four urban background locations (DT 7, DT 155, DT 185, and DT 82) for the remainder. The above methodology has been shown in previous reports to under-estimate NO<sub>2</sub> concentrations at building façades in street canyon environments. Potential exceedances (> 36 µg/m<sup>3</sup>) of the NO<sub>2</sub> annual mean that were identified at relevant locations near the monitoring locations are shown in **Table 3.1**. This information is also presented in **Table C.3** in **Appendix C** under the **NO<sub>2</sub> Fall-off with Distance from the Road** heading.

**Table 3.1 Locations of Potential Exceedances of the NO<sub>2</sub> annual mean AQO in 2021**

Site ID	Location	2021 Bias Adjusted NO <sub>2</sub> Annual Mean (µg/m <sup>3</sup> )	2021 Predicted annual mean NO <sub>2</sub> concentration at Receptor (µg/m <sup>3</sup> )
DT 70	Victoria Rd/Hilltown	40.6	35.0
DT 37	Logie St (114)	38.6	37.0
DT 205	West Marketgait/Old Mill (23)	36.5	36.4
DT 31	Lochee Rd (140) Traffic Lts	36.1	35.5

The highest NO<sub>2</sub> annual mean concentrations predicted at relevant receptors were on the North West arterial route (Logie Street and Lochee Road); the West Marketgait, which is part of the inner ring road; and the main bus corridor (Victoria Road/Hilltown). All of these locations are within the Dundee AQMA.

Long term trends in NO<sub>2</sub> concentrations at automatic monitors with at least 5 years data capture are shown in [Figure A.10a](#). The trend at the urban background site at Mains Loan is relatively stable. An analysis of apparent trends in the 76 monitoring locations with at least 5 years data is

shown in [Figure A.10b](#). Concentrations at all sites show an improving trend or have remained stable.

The greatest improvements have been in Meadowside where action plan measures, i.e. to increase the separation distance between the active carriageway and receptors, have been successful in reducing concentrations. The lockdown measures introduced as a result of the COVID-19 pandemic have slightly accentuated the long term trend downwards at some sites. Stable trends are evident at the Whitehall Crescent (main bus corridor) and Broughty Ferry Road (urban industrial site) sites. NO<sub>2</sub> concentrations at both these locations are below the AQO, with AQ modelling of the impact of the proposed LEZ scheme on NO<sub>2</sub> concentrations within the LEZ area suggesting that concentrations will be further reduced.

An overview of how NO<sub>2</sub> annual mean concentrations are improving in different areas across the city can be seen in maps and graphs shown in [Appendix D](#).

[Table A.4](#) in Appendix A compares the ratified continuous monitored NO<sub>2</sub> hourly mean concentrations for the past five years with the air quality objective of 200µg/m<sup>3</sup>, which is not to be exceeded more than 18 times per year. No exceedances of the hourly mean objective were identified at automatic monitoring locations in 2021. No exceedances of the hourly mean objective were indicated by the diffusion tube annual mean concentrations in 2021 as none exceeded 60µg/m<sup>3</sup>. No automatic monitoring locations recorded occasions when the concentration was over 200µg/m<sup>3</sup> in 2021.

The Lochee Road automatic monitor is the only location where the hourly mean objective has previously been exceeded. There have been no exceedances of this objective at this automatic monitor for the past 8 years. [Figure A.11](#) shows the long-term trend in the 99.8th percentile concentration of hourly means at Lochee Road. The trend line for the 15-year period that hourly levels have been monitored has been drawn using an Excel simple regression statistical program, with a negative value being shown in 2019 for the first time since the AQMA for the hourly objective was declared in 2013. Diffusion tube monitoring and dispersion modelling show that the automatic monitor is not sited in the most polluted location.

In our 2020 Annual Progress Report we considered that there should be an established downward trend before revoking the AQMA for the hourly mean objective. Although this trend has been downward since 2019, levels recorded in 2020 and 2021 will have been impacted on by restrictions associated with the COVID-19 pandemic and as such further monitoring should be analysed before concluding that this part of the AQMA can be revoked.

### **3.1.5 Particulate Matter (PM<sub>10</sub>)**

[Table A.5](#) in Appendix A compares the ratified and adjusted monitored PM<sub>10</sub> annual mean concentrations for the past five years with the air quality objective of 18µg/m<sup>3</sup>.

No exceedances of the PM<sub>10</sub> annual mean objective (18µg/m<sup>3</sup>) were predicted during 2021, within the current AQMA.

Annual mean PM<sub>10</sub> concentrations at monitoring sites with at least five years data are shown in [Figure A.12a](#) and [Figure A.12b](#), with an analysis of the trends shown in [Figure A.12c](#). An improving trend is evident at all current monitoring locations - lockdown measures introduced as a result of the COVID-19 pandemic has slightly accentuated the long term trend downwards at some sites. The largest decreasing trend is evident at Stannergate (Osiris). Traffic is not the only source of PM<sub>10</sub> in the Stannergate area, and two nearby SEPA permitted processes surrendered their licences during 2017. The 2021 data showed a sharp increase compared to previous years however remained below the objective level. Reasons for the increase in 2021 may include a significant amount of earth moving within the Port area to the south-east of this monitor undertaken as a part of the project to increase set down capability within the Port.

[Table A.6](#) in [Appendix A](#) compares the ratified continuous monitored PM<sub>10</sub> daily mean concentrations for the past five years with the air quality objective of 50µg/m<sup>3</sup>, not to be exceeded more than seven times per year.

The PM<sub>10</sub> daily mean objective (50µg/m<sup>3</sup>, not to be exceeded more than 7 times per year) was met at all current monitoring locations during 2021. No monitoring location recorded any potential exceedances of the daily mean objective during 2021. [Figure A.13](#) shows the frequency of the daily mean PM<sub>10</sub> concentrations greater than 50µg/m<sup>3</sup> recorded at the real-time monitors.

All of the automatic monitoring sites with at least 5 years data capture show an improving trend. It is hard however to draw conclusions from the analysis of trends in short-term PM<sub>10</sub> exceedances because apart from the influence of annual transboundary events (usually in March and April) most are caused by transient and sometimes unpredictable events such as road works, fires, road gritting and, demolition and construction activities.

### **3.1.6 Particulate Matter (PM<sub>2.5</sub>)**

Dundee City Council began monitoring for PM<sub>2.5</sub> at the background site at Mains Loan in October 2017. DCC's second PM<sub>2.5</sub> analyser was installed at the Lochee Road monitoring station in March 2018, with a further three PM<sub>2.5</sub> monitors installed in March 2019 (Whitehall Street, Seagate and Meadowside). The most recent PM<sub>2.5</sub> monitor installation was at the Urban Industrial site on Broughty Ferry Road in January 2020. All six of the PM<sub>2.5</sub> monitors are Palas Fidas analysers which measure both PM<sub>10</sub> and PM<sub>2.5</sub>.

[Table A.7](#) in [Appendix A](#) compares the ratified and adjusted monitored PM<sub>2.5</sub> annual mean concentrations for the past five years with the air quality objective of 10µg/m<sup>3</sup>. No exceedances of the PM<sub>2.5</sub> annual mean objective were observed at the monitoring locations in 2021.

The 4 other roadside PM<sub>10</sub> monitoring locations (Albert Street, Logie Street, Myrekirk Road, Stannergate) represent relevant areas for PM<sub>2.5</sub>, so the methodology described in LAQM.TG (16) (paragraph 7.109) has been used to estimate the PM<sub>2.5</sub> annual mean concentrations. Table 3.2 shows those monitoring locations where the PM<sub>2.5</sub> objective has been estimated to be exceeded (highlighted in bold) since the new requirement was introduced. One potential exceedance was estimated at the Stannergate monitoring location in 2021. The concentrations shown in Table 3.2 are estimated concentrations at indicative analysers using the assumed ratio of PM<sub>2.5</sub> to PM<sub>10</sub> of 0.7 as described in LAQM.TG (16)(April2021) (paragraph 7.111). However, analysis of the actual ratio of PM<sub>2.5</sub> to PM<sub>10</sub> at monitored roadside sites in Dundee in 2021 gives an average ratio of 0.53. Applying this ratio to the results would bring all the estimated concentrations below 10µg/m<sup>3</sup> in Table 3.2, which would indicate, along with actual monitored PM<sub>2.5</sub> concentrations, that an AQMA for PM<sub>2.5</sub> is not required.

**Table 3.2 Estimated PM<sub>2.5</sub> Annual Mean Concentrations 2015 to 2021 using 0.7 ratio PM<sub>2.5</sub> to PM<sub>10</sub>**

Year	2015	2016	2017	2018	2019	2020	2021
<i>Scottish Annual Mean Objective</i>	10	10	10	10	10	10	10
Logie St (Osiris)	<b>10.9</b>	9.7	10.2	<b>13.2</b>	<b>10.8</b>	9.8	8.0
Myrekirk Tce (Osiris)	<b>12.9</b>	<b>10.9</b>	8.4	9.5	8.6	7.7	8.9
Albert St (Osiris)	<b>13.3</b>	<b>10.8</b>	10.0	<b>12.3</b>	<b>10.6</b>	9.7	7.8
Stannergate (Osiris)	<b>18.8</b>	<b>14.6</b>	9.8	8.3	9.3	8.1	<b>11.5</b>

### 3.1.7 Sulphur Dioxide (SO<sub>2</sub>)

Dundee City Council does not currently monitor SO<sub>2</sub>.

### 3.1.8 Carbon Monoxide, Lead and 1,3-Butadiene

Dundee City Council does not currently monitor any of these pollutants.



## 4 New Local Developments

### Road Traffic Sources

Under this section the Council is required to identify any of the following which are new:

- Narrow congested streets with residential properties close to the kerb;
- Busy streets where people may spend one hour or more close to traffic;
- Roads with a high flow of buses and/or HGVs;
- Junctions;
- New roads constructed or proposed;
- Roads with significantly changed traffic flows; and
- Bus or coach stations.

Since the Annual Progress Report 2021 there have been none of the following identified as being new:

- Busy streets where people may spend one hour or more close to traffic;
- Roads with a high flow of buses and/or HGVs;
- Junctions;
- New roads constructed or proposed;
- Bus or coach stations.

Planning application 20/00679/FULM was approved during 2021. It was identified during the planning application process that the scale of the development and its proximity to the dual carriageway would likely cause a short street canyon effect along this roadway and as such would need to be assessed. This is further discussed in [Table 5.1](#) in Chapter 5.

Annual road count data (as AADT) from Dundee City Council's long-term Road Traffic Reduction Act (RTRA) Sites from 2005-2021 are presented in [Table E.1](#). Unfortunately data for some RTRA sites were unavailable for 2021 (and 2020) at the time of writing, however as shown in the table, the COVID-19 lockdown restrictions put in place on travel and work in 2020 has greatly reduced road traffic levels across the city.

[Table E.2](#) shows the percentage growth at each of the RTRA sites since 2005. Only one site, Tay Bridge, had experienced a significant increase (>10%) in traffic flows over the period ending 2019. There is currently no relevant exposure within 10m of this location. Data for 2021 shows a continued reduction in traffic levels across the sites in Dundee compared to 2019 pre-pandemic

levels. Consequently, updated assessments of NO<sub>2</sub> and PM<sub>10</sub> are not required for those RTRA Sites where there is relevant exposure.

Bus priority measures were introduced on Meadowside in March 2021. The measures remove general traffic (cars etc) going north bound at the Meadowside signals near the Wellgate centre, with traffic diverted onto Bell Street from Meadowside to join at Victoria Street west of the Meadowside signals. This will reduce the flow of general traffic past the Meadowside automatic monitor, however diverted traffic will pass by NO<sub>2</sub> passive diffusion tubes located on Victoria Road.

Approval was given in 2021 to install a central island to prevent drivers from turning right from Cleghorn Street on to Lochee Road, from Lochee Road on to Cleghorn Street, and from Rankine Street on to Lochee Road. Drivers will also not be able to cross Lochee Rd from Rankine Street on to Cleghorn Street or vice-versa. This will have benefits for both road safety and help ease congestion being caused by vehicles looking to make these right-hand turns. The Lochee Road automatic monitor is located just north of this junction. These works were scheduled to take place in the first half of 2022.

### Other Transport Sources

None of the following transport sources have been identified as new since the Annual Progress Report 2021:

- Airports;
- Locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m;
- Locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m; and
- Ports for shipping.

### Industrial Sources

Under this section the local authority is required to identify any of the following which are new:

- **Industrial installations:** new or proposed installations for which an air quality assessment has been carried out;
- **Industrial installations:** existing installations where emissions have increased substantially or new relevant exposure has been introduced;
- **Industrial installations:** new or significantly changed installations with no previous air quality assessment;
- Major fuel storage depots storing petrol;
- Petrol stations; and

- Poultry farms.

Industrial sources are regulated by the Scottish Environment Protection Agency (SEPA) under the Pollution Prevention and Control Regulations (PPC). Local authorities also have controls over smaller industrial and commercial sources, largely through the Clean Air Act and its associated control of stack heights. As a result of these controls, there should be few sources that may be relevant to local authorities under the Local Air Quality Management (LAQM) regime. The majority of these sources will have been previously addressed and the focus is, therefore, on new installations and those with significantly changed emissions or new exposure.

The technical guidance (LAQM.TG(16)) states that industrial sources are unlikely to make a significant contribution to annual mean concentrations, but may contribute to elevated short-term concentrations, which may lead to exceedances of the short-term air quality objectives (e.g. 15-minute mean for SO<sub>2</sub>, 1-hour mean for NO<sub>2</sub> or 24-hour mean for PM<sub>10</sub>). The assessment should consider the potential impact of specific industrial processes or chemical storage for all of the regulated pollutants. Generally, industrial sources most likely to require further assessment work are those that emit NO<sub>2</sub>, PM<sub>10</sub> and potentially SO<sub>2</sub>.

A list of industrial processes in the city which were regulated by the Scottish Environmental Protection Agency (SEPA) at the end of 2019 is provided in [Appendix F](#).

- **New or Proposed Installations for which an Air Quality Assessment has been Carried Out**

SEPA were consulted however advised that they were unable to provide updates on local PPC sites for the 2022 Annual Progress Report. During 2021 no applications for a new PPC installation were received by the Council as part of the SEPA consultation process.

- **Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been Introduced**

SEPA were consulted however advised that they were unable to provide updates on local PPC sites for the 2022 Annual Progress Report.

- **New or Significantly Changed Installations with No Previous Air Quality Assessment**

SEPA were consulted however advised that they were unable to provide an update on existing installations for this report.

- **Major Fuel (Petrol) Storage Depots**

The assessment considers benzene, with respect to the 2010 objective. There are no major fuel (petrol) storage depots within the Local Authority area.

- **Petrol Stations**

The assessment considers benzene with respect to the 2010 objective. Large petrol stations, where the annual throughput is more than 2000m<sup>3</sup> of petrol (2 million litres per annum) and with a busy road nearby (i.e. >30,000 annual average daily traffic flows) require consideration where there is relevant exposure (e.g. residential properties) within 10m of the pumps. All existing petrol stations have been assessed previously and there are no residences within 10m of the pumps.

Dundee City Council confirms that there are no new petrol stations meeting the specified criteria.

### ▪ **Poultry Farms**

Farms housing in excess of: 400,000 birds if mechanically ventilated; 200,000 birds if naturally ventilated; and, 100,000 birds for any turkey unit, require consideration if there is residential exposure within 100m of the poultry units. The assessment needs to consider only PM<sub>10</sub>.

Dundee City Council confirms that there are no poultry farms meeting the specified criteria in Dundee.

### **Commercial and Domestic Sources**

Under this section the Council is required to identify any of the following which are new since the last Annual Progress Report:

- Biomass<sup>1</sup> combustion plant – individual installations (50kW to 20MW);
- Areas where the combined impact of several biomass combustion sources may be relevant;
- Areas where domestic solid fuel burning may be relevant; and
- Combined Heat and Power (CHP) Plant.

Since the APR 2021, there have been no new biomass combustion installations nor areas identified where the combined impact of several biomass sources may be relevant. Smoke Control Orders cover most of the local authority area and there are currently no areas identified with significant solid fuel use, though regular enquiries / complaints to the Council about domestic solid fuel burning, and planning applications for the installation of wood/solid fuel burning stoves are received.

The requirement to consider CHP Plant is a new requirement that local authorities have had to report since the APR 2016. No new CHP plants were identified during 2021.

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<sup>1</sup> Note (from Defra FAQ 2009): the term 'biomass' strictly applies to all solid fuels made from plants, i.e. coal, smokeless fuels, wood, straw etc... However, the term biomass is now frequently taken to be synonymous with renewable fuels such as wood and straw. For the purposes of air quality review and assessment the strict definition of biomass is applicable.

### **New Developments with Fugitive or Uncontrolled Sources**

Under this section the Council is required to identify any of the following potential sources of fugitive or uncontrolled particulate matter, which are new:

- Landfill sites;
- Quarries;
- Unmade haulage roads on industrial sites;
- Waste transfer stations etc.; and
- Other potential sources of fugitive particulate emissions.

The Port of Dundee is an ever changing area of activity with many varying projects to improve the facilities and capabilities of the Port in recent years. This has included the addition of increased lifting capabilities and a new quayside at the eastern end of the Port to help bring forward opportunities for decommissioning and the offshore wind farm industry. The Port also provides accommodation for jack up drilling rigs for inspection, repair and maintenance of these jack up rigs which may remain at the Port for many months at a time. The Port is a major grain handling port with the largest grain drying facility in Scotland also located within the Port boundary.

Work to create an extensive set down area for the storage of items arriving to the Port, such as wind turbine components, was undertaken in 2021 with this project included a significant amount of earthwork. The access point to this area is approximately 200m south of the Stannergate PM<sub>10</sub> OSIRIS unit. As reported on Section 3.1.5 of Chapter 3, there was a sharp increase in the increase in the annual mean PM<sub>10</sub> concentration at this indicative monitor compared to recent years and although the monitored levels had increased, they were still below the objective level for Scotland.

As many of the activities carried out at the Port are potential sources of fugitive particulate emissions, pollutant monitoring will continue around the port to determine whether further action plan measures are necessary.

## 5 Planning Applications

This section identifies any major planning application that was granted permission during 2021 that may impact on air quality. The planning applications referred to in Table 5.1 can be found on the Council's website ( <https://idoxwam.dundeecity.gov.uk/idoxpa-web/> ) using the reference numbers detailed below with each case.

**Table 5.1 Major planning applications approved in 2021 that may affect air quality**

Planning Application	Application Number	Air Quality Impacts
<p>Development of site for the storage of operational vehicles, including resurfacing, amendments to access, associated parking and ancillary infrastructure.</p>	<p>20/00589/FULM</p>	<p>This was approved subject to conditions on 25 March 2021.</p> <p>The storage facility would provide parking and storage space for delivery vans associated with an existing distribution and delivery business at Riverside Drive.</p> <p>The proposals include the provision of infrastructure including substations and underground cabling to provide all 124 vehicle parking spaces with electric charging points. The provision of charging points will be introduced on a phased basis, with initially one active electric vehicle charging space being provided with the remainder of the spaces being delivered for electric vehicle charging as the power supply to the site is upgraded. In addition to sub stations, back-up generators will be required to ensure the continuous provision of electricity to electric charging points.</p> <p>Environmental Health (Air Quality) advised that the provision of electric charging points within the site is supported, subject to a detailed timescale for the full implementation of the charging points being provided. The possible requirement for an electric generator, should initial electricity supplies not be sufficient, could raise air quality concerns. If a generator is required, an updated Air Quality Report will be required.</p> <p>The applicant submitted an Air Quality Assessment with the application. The assessment considered that the construction and operation of the proposed vehicle storage facility, including phased introduction of electric vehicle and associated charging provision, would have a negligible impact on local air quality and that no</p>

		mitigation measures are required. However, the addition of back up electricity generators within the site has not been considered within the report. As the type and form of generator is unknown at this stage, the provision of an amended Air Quality Assessment prior to the addition of any generators on site will be controlled by condition. The amended report will require to consider the impacts of the generators on air quality and identify any mitigation measures.
Erection of a purpose built student accommodation development comprising 179 bedrooms and associated amenity space, landscaping, access and associated works.	20/00679/FULM	<p>This was approved subject to conditions on 20 April 2021.</p> <p>As the site is within close proximity to a busy dual carriageway an Air Quality Report was requested by Environmental Health (Air Quality). Following a review of the submitted Air Quality Report, further assessment of the proposed developments impact on air quality within the surrounding area was identified as being required as the scale of the proposed building would result in reduced dispersion of air along this section.</p> <p>Planning conditions were recommended by Environmental Health (Air Quality) requiring further assessment be submitted, full details of a whole house ventilation strategy are provided if required, and for a construction dust mitigation plan to be implemented. These conditions were attached to the planning consent.</p>
Planning permission is sought for the erection of office accommodation, 16 residential apartments and four commercial units.	21/00274/FULM	<p>This was approved subject to conditions on 16 June 2021.</p> <p>As the proposed development is of a large scale and includes a diesel-powered back-up generator for use in the event of power cuts, the development could contribute to pollution in the local area and as such an Air Quality Report was requested by Environmental Health (Air Quality). Following a review of the submitted Air Quality Report and supporting information, further assessment of the</p>



		<p>proposed developments was identified as being required to demonstrate the impact of the proposed development on local air quality, and to ensure the back-up generator is served by a flue/stack of appropriate height.</p> <p>The east façade of the proposed development is within close proximity to West Marketgait. Due to high traffic volumes on West Marketgait, air quality in this location is poor and could have a detrimental impact on health. To ensure residents of the proposed development are provided with a supply of clean air a mechanical ventilation system(s) may be required. Should the revised Air Quality Assessment determine the need for a mechanical ventilation system, it is recommended the provision of full details of a suitable system, including the location of the air intake(s), are controlled by condition within any consent granted.</p> <p>Recommended planning conditions were put forward by Environmental Health (Air Quality) asking for full details of the back-up generator and an associated operating plan, full details of a whole house ventilation strategy if required, and that a construction dust mitigation plan is implemented during construction. These conditions were attached to the planning approval.</p>
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## 6 Conclusions and Proposed Actions

### Conclusions from New Monitoring Data

Due primarily to ongoing lockdown measures which contributed to reduced road traffic levels across Scotland, in 2021 there were no potential exceedances of the NO<sub>2</sub> annual mean objective (40µg/m<sup>3</sup>) at receptor locations, within the Dundee AQMA.

No exceedances of the NO<sub>2</sub> hourly mean objective were identified by automatic monitors or indicated by diffusion tubes in 2021. Lochee Road is the only area of the city where the hourly AQO has been exceeded previously. No exceedances of the hourly mean were recorded in 2021, and for the past 8 years the objective (18 exceedances are allowed) has been achieved. The trend line in the 99.8th percentile concentration showed at negative value for the first time in 2019 since the AQMA for the hourly mean was declared in 2013. This downward trend has continued however it is recognised that the impacts of the COVID-19 restrictions on road traffic levels during 2020 and 2021 will have been the main influence on the reduced NO<sub>2</sub> concentrations. We therefore consider it necessary refrain from removing the AQMA for the hourly mean AQO until it is clear that traffic levels have stabilised and the downward trend is evident.

No exceedances of the PM<sub>10</sub> annual mean objective (18µg/m<sup>3</sup>) were predicted during 2021.

An improving trend is evident at all current monitoring locations. The largest decreasing trend is evident at Stannergate (Osiris). Traffic is not the only source of PM<sub>10</sub> in the Stannergate area, and two nearby SEPA permitted processes surrendered their licences during 2017. Whitehall Street is included as this is the first time there has been five years' worth of data. The lockdown measures introduced as a result of the pandemic has slightly accentuated the long-term trend downwards at some sites.

The PM<sub>10</sub> daily mean objective (50µg/m<sup>3</sup>, not to be exceeded more than 7 times per year) was met at all monitoring locations during 2021.

All of the automatic monitoring sites with at least 5 years data capture show an improving trend. However, it is hard to draw conclusions from the analysis of trends in short-term PM<sub>10</sub> exceedances because apart from the influence of annual transboundary events (usually in March and April) most are caused by transient and sometimes unpredictable events such as road works, fires, road gritting and, demolition and construction activities.

No monitored exceedances of the PM<sub>2.5</sub> annual mean objective (10µg/m<sup>3</sup>) were recorded in Dundee during 2021. A potential exceedance of the PM<sub>2.5</sub> annual mean objective (10µg/m<sup>3</sup>) at one location was estimated from the PM<sub>10</sub> annual mean concentrations using the methodology described in LAQM.TG(16). Applying the actual ratio of PM<sub>2.5</sub> to PM<sub>10</sub> at the monitored roadside

sites in Dundee in 2021 would however bring the estimated potential exceedance value to below the 10ug/m<sup>3</sup> objective level.

### **Conclusions relating to New Local Developments**

Two major developments containing residential properties adjacent to sections of the road network with high traffic flow were granted permission in 2021. Conditions were attached to each consent requiring mitigating measures to protect the amenity of future residents. In addition, the potential impact of the size of one of the developments on the dispersion of air along the section of road was also required to be assessed.

Developments incorporating diesel-powered generators for use in the event of power cuts were also approved, with planning consent conditions requiring further details and operating plans of these generators to be provided and if necessary, amended Air Quality Assessments.

Traffic flows from the council's Road Traffic Reduction Act Sites from 2021 were reviewed, the lockdown measures put in place as a result of the pandemic greatly reduced road traffic in the first half of 2021 however by the end of the year levels were returning to close to pre-pandemic levels. Measures that will assist the flow of traffic through a junction on Lochee Road were approved in 2021, while bus priority measures were introduced on Meadowside in March 2021.

No new areas requiring assessment were identified. There were no new 'other transport' sources identified in Section 4 during 2021.

No new industrial sources were identified in 2021.

No new commercial or domestic sources which met the criteria outlined in Section 4 were identified during 2021.

As previously reported there is the potential for an increase in uncontrolled fugitive particulate matter as a consequence of movements of heavy vehicles over unmade ground within the port. Activities within the port were previously identified as contributing to elevated PM<sub>10</sub> concentrations measured at the Stannergate monitoring station, although this had reduced in recent years. During 2021 there was a sharp increase at the Stannergate monitoring station, with a possible source being the large amount of earth works undertaken in 2021 as a part of a project to increase setting down area capability. Although this location had seen a reduction in the measured concentrations of PM<sub>10</sub>, as many of the activities carried out at the Port are potential sources of fugitive particulate emissions, pollutant monitoring will continue around the Port to determine whether further action plan measures are necessary.

### **Proposed Actions**

The 2021 monitoring data did not identify the need to declare an AQMA for any additional pollutants or objectives. None of the 2020 diffusion tubes identified a new area of exceedance outside of the known hotspots, although the lockdown measures put in place as a result of the

pandemic has resulted in reduced concentrations across the local authority, including at these known hotspot areas.

The following actions are proposed following the review and assessment of monitoring data and new developments:

- Continue monitoring of fugitive PM<sub>10</sub> sources around the port area;
- Report on any new or significantly changed SEPA prescribed process;
- Monitor planning applications for new pollution sources, relevant exposure and creation of 'street canyons' while also reviewing additional information being provided for applications approved in and prior to 2021;
- Implement the action plan measures being taken forward in 2022/23;
- Continue with the review and update of the existing 2011 Air Quality Action Plan to reflect the improvements made to air quality in Dundee over the 11 years of the plan being in place, identify any areas where new actions are required, and to align the plan with Dundee LEZ scheme and the new Scottish Government Cleaner Air for Scotland 2 strategy; and,
- Submit the next Annual Air Quality Progress Report in 2023.

## Appendix A: Monitoring Results

### Monitoring locations

Table A.1 Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA? (Y/N)	Monitoring Technique	Distance to Relevant Exposure? (m) <sup>(1)</sup>	Distance to Kerb of Nearest Road (m) <sup>(2)</sup>	Inlet Height (m)
CM 3	Broughty Ferry Road Rollalong	Urban Industrial	341970	730977	PM <sub>10</sub>	Y	TEOM	0	6.88	2.93
					NO <sub>2</sub>		Chemiluminescent <sup>g</sup>		6.63	2.97
					PM <sub>10</sub> & PM <sub>2.5</sub>	Fidas <sup>k</sup>	6.63		2.86	
CM 13	Broughty Ferry Road Partisol	Urban Industrial	341971	730978	PM <sub>10</sub>	Y	Partisol	0	6.11	2.84
CM 4	Lochee Road Romon	Roadside	338861	730773	NO <sub>2</sub>	Y	Chemiluminescent <sup>b f</sup>	2.15 (2.24)	1.00 (1.15)	1.95 (1.77)
					PM <sub>10</sub>		Beta Attenuation (BAM) <sup>f</sup>			2.06
					PM <sub>10</sub> & PM <sub>2.5</sub>		Fidas <sup>f</sup>			2.21
CM 9	Logie Street Osiris	Kerbside	338176	731298	PM <sub>10</sub>	Y	Osiris (nephthalometer)	1.65	0.57	3.31
CM 12	Mains Loan	Urban Background	340972	731893	NO <sub>2</sub>	Y	Chemiluminescent <sup>c</sup>	0	n/a	1.80
					PM <sub>10</sub> & PM <sub>2.5</sub>		Fidas <sup>e</sup>			2.43
CM 5	Seagate Romon	Roadside	340487	730446	NO <sub>2</sub>	Y	Chemiluminescent <sup>b</sup>	2.00	1.10	1.70
					PM <sub>10</sub>		Beta Attenuation (BAM)			2.06
					PM <sub>10</sub> & PM <sub>2.5</sub>		Fidas <sup>h</sup>			2.53
CM 2	Union Street Rollalong <sup>j</sup>	Roadside	340235	730091	NO <sub>2</sub>	Y	Chemiluminescent <sup>b</sup>	3.55	1.64	2.92
					PM <sub>10</sub>		Beta Attenuation (BAM) <sup>a</sup>			3.00

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA? (Y/N)	Monitoring Technique	Distance to Relevant Exposure? (m) <sup>(1)</sup>	Distance to Kerb of Nearest Road (m) <sup>(2)</sup>	Inlet Height (m)
CM 6	Whitehall Street Romon	Roadside	340278	730156	NO <sub>2</sub>	Y	Chemiluminescent <sup>b</sup>	1.86	3.26	1.80
					PM <sub>10</sub>		Beta Attenuation (BAM)	1.79	3.33	2.06
					PM <sub>10</sub> & PM <sub>2.5</sub>		Fidas <sup>h</sup>	1.63	3.52	2.62
CM 14	Meadowside Romon	Roadside	340243	730653	NO <sub>2</sub>	Y	Chemiluminescent <sup>d</sup>	0.42	3.59 (1.60) <sup>i</sup>	2.26
					PM <sub>10</sub>		Beta Attenuation (BAM)		3.65 (1.63) <sup>i</sup>	2.17
					PM <sub>10</sub> & PM <sub>2.5</sub>		Fidas <sup>h</sup>	0.79	3.53	2.63
CM 15	Albert Street Osiris	Kerbside	341090	731105	PM <sub>10</sub>	Y	Osiris (nephthalometer)	1.54	0.89	3.15
CM 16	Broughty Ferry Road Osiris	Urban Industrial	341970	730977	PM <sub>10</sub>	Y	Osiris (nephthalometer)	0	7.15	3.00
CM 17	Myrekirk Osiris	Roadside	335438	731740	PM <sub>10</sub>	Y	Osiris (nephthalometer)	0.4	14.00	3.11
CM 18	Stannergate Osiris	Roadside	343322	731073	PM <sub>10</sub>	Y	Osiris (nephthalometer)	1.93	1.16	3.11

**Notes:**

- (1) "0" if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property or representative of a residential area).
- (2) N/A if not applicable. 'Kerb' is taken as being the edge of the carriageway with flowing traffic
  - <sup>a</sup> During 2013 equipment was updated from TEOM to BAM
  - <sup>b</sup> During 2013 equipment was updated from model ML 9841A to model API T200
  - <sup>c</sup> Equipment model up to 21 September 2022 was Thermo 42i. From 21 September 2022 it was a TAPI T200.
  - <sup>d</sup> Equipment model up to 1<sup>st</sup> March 2021 was ML 2041. From 1<sup>st</sup> March 2021 the equipment was Serinus S40 IZS configuration.
  - <sup>e</sup> During 2017 equipment was updated from TEOM to Palas Fidas
  - <sup>f</sup> On 23<sup>rd</sup> March 2018 monitoring station upgraded with new enclosure and Palas Fidas replaced BAM. NO<sub>x</sub> inlet position changed slightly old measurements shown in brackets
  - <sup>g</sup> API T200 NO<sub>x</sub> analyser relocated from closed Union Street Station in January 2016
  - <sup>h</sup> During March 2019 equipment was updated from BAM to Palas Fidas
  - <sup>i</sup> Measurements amended to reflect change in pavement width, see Erratum in Appendix C.5 APR2020, old measurements shown in brackets
  - <sup>j</sup> CM2 Union Street – was discontinued in January 2016
  - <sup>k</sup> On 8<sup>th</sup> January 2020 equipment was updated from TEOM to Palas Fidas

Figure A.8 Automatic Monitoring Sites 2021

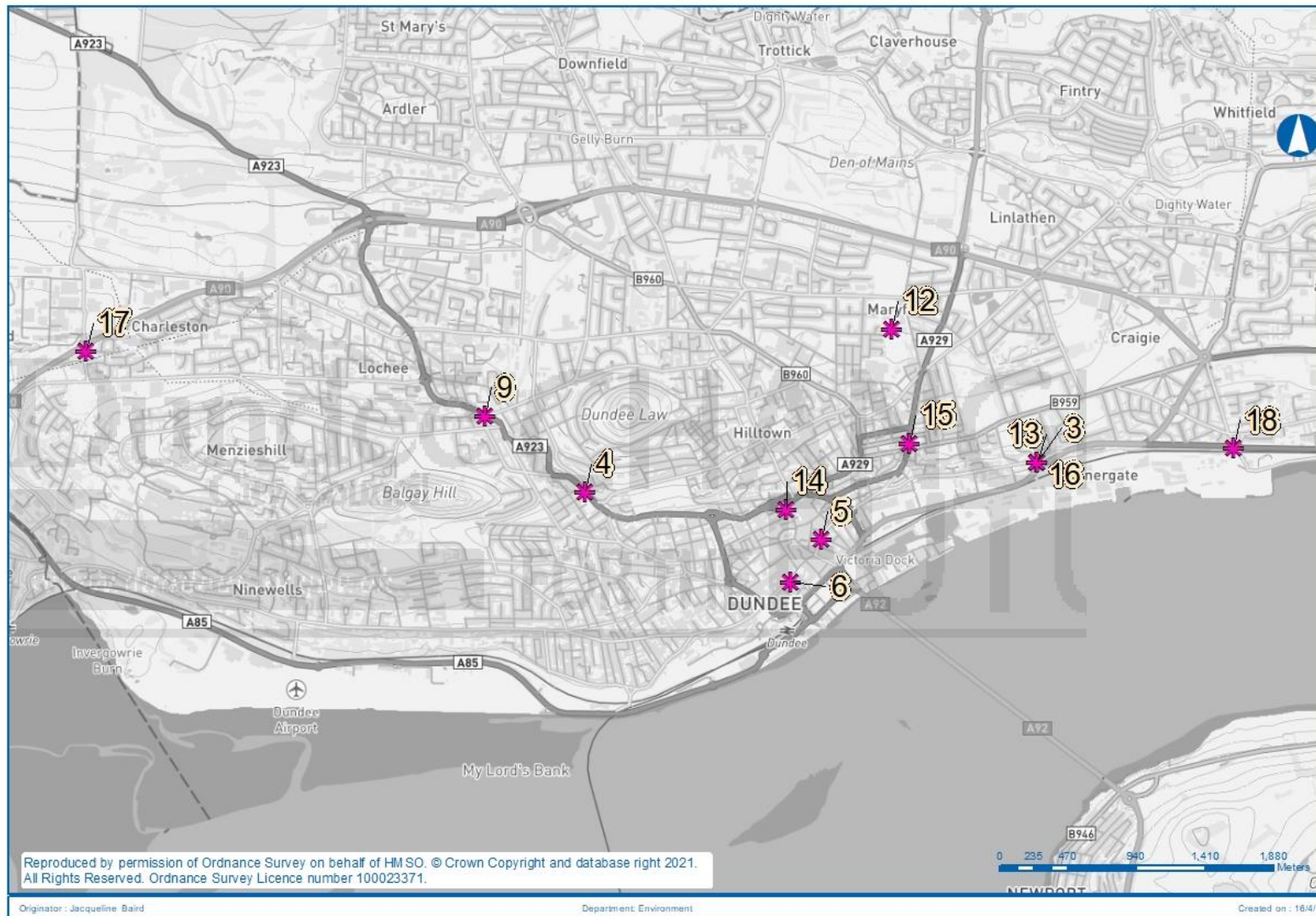


Table A.2 Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type <sup>(1)</sup>	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA ? (Y/N)	Monitoring Technique	Distance to Relevant Exposure ? (m) <sup>(2)</sup>	Distance to Kerb of Nearest Road (m) <sup>(3)</sup>	Tube collocated with a Continuous Analyser ?
DT 92	Abertay 2	R	340019	730612	NO <sub>2</sub>	Y	PDT	2.01	1.95	N
DT 179	Albert St (15) (Facade)	R	341092	731121	NO <sub>2</sub>	Y	PDT	0.25	2.04	N
DT 180	Albert St (15) (Rdside)	K	341091	731121	NO <sub>2</sub>	Y	PDT	1.75	0.54	N
DT 167	Albert St (191)	K	341161	731535	NO <sub>2</sub>	Y	PDT	2.70	0.62	N
DT 5	Arbroath Rd (13)	K	341111	731070	NO <sub>2</sub>	Y	PDT	2.52	0.73	N
DT 7	Balgavies Place	UB	343082	731465	NO <sub>2</sub>	Y	PDT	n/a	n/a	N
DT 9	Birnam Place	UB	337531	730914	NO <sub>2</sub>	Y	PDT	n/a	n/a	N
DT 223	Broughty Ferry Rd – Lower (Cycle sign)	UB	343530	730937	NO <sub>2</sub>	Y	PDT	n/a	2.84	N
DT 204	Broughty Ferry Rd (129)	R	342244	731066	NO <sub>2</sub>	Y	PDT	3.57	2.27	N
DT 139	Broughty Ferry Rd (141 Downpipe)	R	343317	731072	NO <sub>2</sub>	Y	PDT	0.20	4.32	N
DT 11	Broughty Ferry Rd (141)	R	343322	731073	NO <sub>2</sub>	Y	PDT	1.98	1.32	N
DT 145	Broughty Ferry Rd (Greendykes)	R	342662	731112	NO <sub>2</sub>	Y	PDT	7.72	4.10	N
DT 155	Carolina Court LP6	UB	342353	731058	NO <sub>2</sub>	Y	PDT	n/a	n/a	N
DT 171	Claypotts / Arbroath Rd (502)	R	345347	732080	NO <sub>2</sub>	Y	PDT	5.30	11.20	N
DT 242	Cleington Rd / Mains Loan	R	341050	732111	NO <sub>2</sub>	Y	PDT	n/a	1.94	N
DT 13	Cleington Rd/ Forfar Rd	K	341385	732121	NO <sub>2</sub>	Y	PDT	8.28	0.78	N
DT 188	Commercial St (9)	R	340544	730291	NO <sub>2</sub>	Y	PDT	2.44	2.57	N
DT 84	Commercial St/Dock St (40)	R	340565	730263	NO <sub>2</sub>	Y	PDT	0.17	2.78	N
DT 85	Dock St (21)	R	340524	730216	NO <sub>2</sub>	Y	PDT	0.34	5.13	N
DT 156	Dock St (57)	R	340656	730343	NO <sub>2</sub>	Y	PDT	3.25	2.53	N
DT 241	Dock St (Customs House)	R	340691	730344	NO <sub>2</sub>	Y	PDT	1.42	3.24	N
DT 243	Dock St / Gellatly St	R	340638	730328	NO <sub>2</sub>	Y	PDT	0.65	5.00	N
DT 233	Dock St/Trades Lane	R	340690	730382	NO <sub>2</sub>	Y	PDT	n/a	6.14	N
DT 227	Dudhope Crescent Road (40)	K	339830	730619	NO <sub>2</sub>	Y	PDT	1.99	0.83	N
DT 20	Dura St (100)	K	341150	731576	NO <sub>2</sub>	Y	PDT	1.65	0.57	N



Site ID	Site Name	Site Type <sup>(1)</sup>	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA ? (Y/N)	Monitoring Technique	Distance to Relevant Exposure ? (m) <sup>(2)</sup>	Distance to Kerb of Nearest Road (m) <sup>(3)</sup>	Tube collocated with a Continuous Analyser ?
DT 214	East Dock Street (26)	R	340725	730417	NO <sub>2</sub>	Y	PDT	0.20	3.70	N
DT 22	Eastport Roundabout	R	340651	730623	NO <sub>2</sub>	Y	PDT	1.56	1.00	N
DT 83	Forfar Rd (104)	K	341437	732360	NO <sub>2</sub>	Y	PDT	7.68	0.67	N
DT 177	Kingsway / Strathmartine Rd (279)	R	339179	732896	NO <sub>2</sub>	Y	PDT	3.63	3.14	N
DT 26	Kingsway East Roundabout	R	343107	731740	NO <sub>2</sub>	Y	PDT	14.30	2.90	N
DT 27	Kingsway/ Mains Loan	R	341124	732468	NO <sub>2</sub>	Y	PDT	15.40	6.20	N
DT 30	Lochee Rd (138)	K	338936	730680	NO <sub>2</sub>	Y	PDT	2.06	0.44	N
DT 31	Lochee Rd (140) Traffic Lts	R	338927	730685	NO <sub>2</sub>	Y	PDT	0.25	2.22	N
DT 32	Lochee Rd (184)	K	338767	730856	NO <sub>2</sub>	Y	PDT	3.19	0.73	N
DT 158	Lochee Rd (Romon) Average	R	338861	730773	NO <sub>2</sub>	Y	PDT	2.03	1.34	Y
DT 36	Lochee Rd/Polepark Rd	K	339016	730586	NO <sub>2</sub>	Y	PDT	9.21	0.95	N
DT 37	Logie St (114)	R	338184	731293	NO <sub>2</sub>	Y	PDT	0.53	1.73	N
DT 38	Logie St (98)	K	338252	731258	NO <sub>2</sub>	Y	PDT	n/a	0.84	N
DT 39	Loons Rd (1)	R	338211	731293	NO <sub>2</sub>	Y	PDT	0.50	1.90	N
DT 237	Lower Princess St	R	340964	730855	NO <sub>2</sub>	Y	PDT	0	2.44	N
DT 149	Meadowside (Romon) Average	R	340243	730653	NO <sub>2</sub>	Y	PDT	0.33	3.68	Y
DT 42	Muirton Rd (6)	R	338156	731294	NO <sub>2</sub>	Y	PDT	0.30	1.11	N
DT 185	Murraygate (46)	UB	340409	730484	NO <sub>2</sub>	Y	PDT	n/a	n/a	N
DT 189	Myrekirk Rd (29)	R	335420	731726	NO <sub>2</sub>	Y	PDT	5.17	2.00	N
DT 47	Nethergate (40)	R	340230	730124	NO <sub>2</sub>	Y	PDT	2.72	1.26	N
DT 45	Nethergate (6)	R	340274	730171	NO <sub>2</sub>	Y	PDT	2.51	1.25	N
DT 213	Nethergate (64)	R	340196	730089	NO <sub>2</sub>	Y	PDT	2.40	4.15	N
DT 44	Nethergate (88)	K	340163	730061	NO <sub>2</sub>	Y	PDT	5.00	0.86	N
DT 46	Nethergate (95)	K	340033	729957	NO <sub>2</sub>	Y	PDT	1.84	0.86	N
DT 48	Nethergate(132) / Marketgait	R	340074	729984	NO <sub>2</sub>	Y	PDT	3.60	1.33	N
DT 239	Princes St (185)	K	341077	731031	NO <sub>2</sub>	Y	PDT	2.40	0.60	N

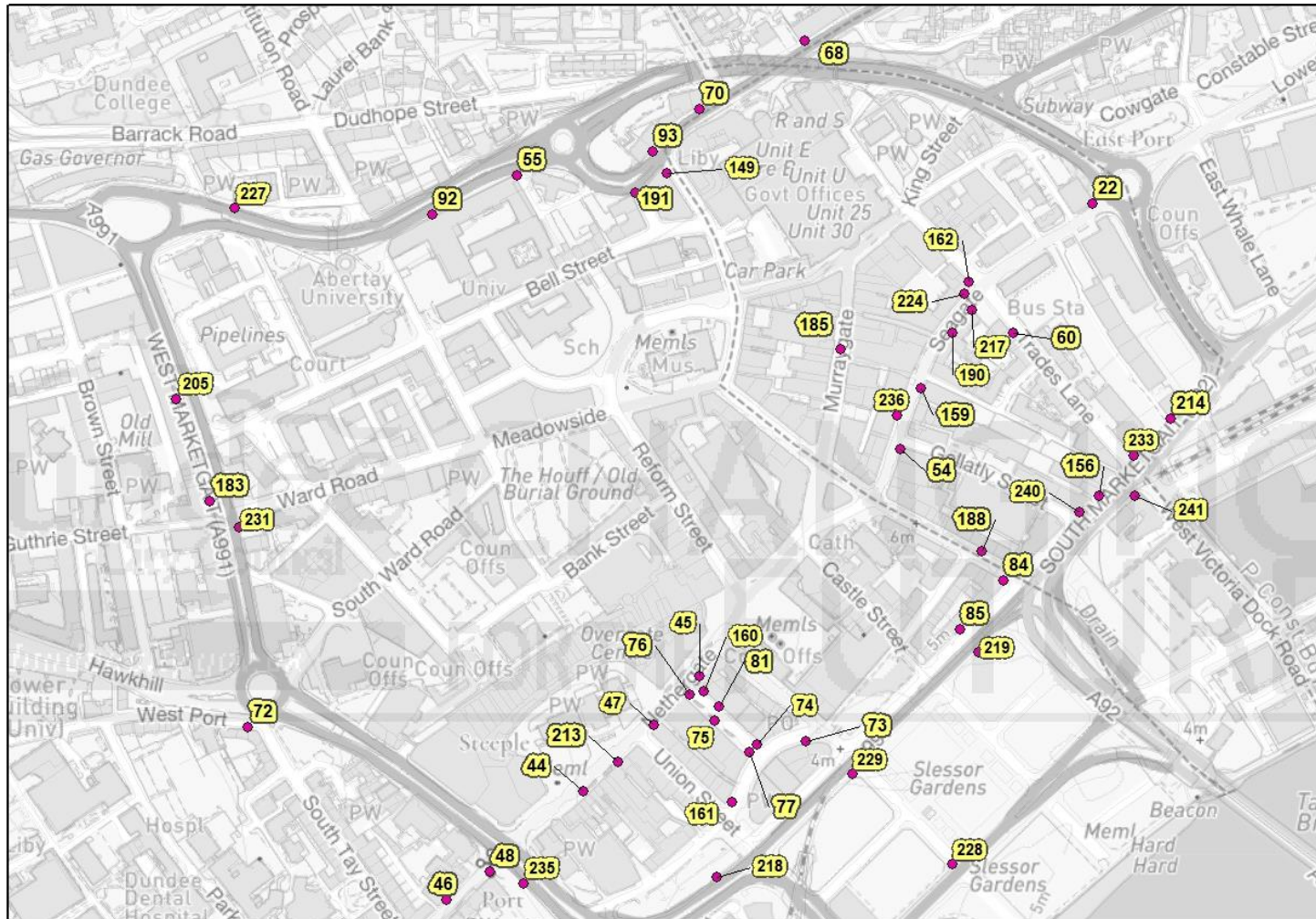
Site ID	Site Name	Site Type <sup>(1)</sup>	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA ? (Y/N)	Monitoring Technique	Distance to Relevant Exposure ? (m) <sup>(2)</sup>	Distance to Kerb of Nearest Road (m) <sup>(3)</sup>	Tube collocated with a Continuous Analyser ?
DT 49	Rankine St (2)	R	338768	730900	NO <sub>2</sub>	Y	PDT	0.40	1.76	N
DT 228	Riverside Esplanade / S. Crichton St.	R	340516	729991	NO <sub>2</sub>	Y	PDT	1.17	2.74	N
DT 224	Seagate (112)	R	340528	730537	NO <sub>2</sub>	Y	PDT	0	2.64	N
DT 236	Seagate (36-40)	R	340463	730420	NO <sub>2</sub>	Y	PDT	0.20	2.76	N
DT 54	Seagate (9)	R	340467	730388	NO <sub>2</sub>	Y	PDT	0.90	1.70	N
DT 190	Seagate (97)	R	340516	730499	NO <sub>2</sub>	Y	PDT	0	2.26	N
DT 217	Seagate (99)	R	340535	730522	NO <sub>2</sub>	Y	PDT	0	2.35	N
DT 159	Seagate(Romon) Average	R	340487	730446	NO <sub>2</sub>	Y	PDT	1.81	1.29	Y
DT 55	Soapwork Lane	R	340099	730650	NO <sub>2</sub>	Y	PDT	0	3.51	N
DT 218	South Marketgait (Lampost 18)	R	340291	729979	NO <sub>2</sub>	Y	PDT	n/a	2.58	N
DT 235	South Marketgait/Nethergate <sup>(e)</sup>	R	340106	729972	NO <sub>2</sub>	Y	PDT	0.15	2.88	N
DT 151	South Rd (1 Denbank)	R	335188	731528	NO <sub>2</sub>	Y	PDT	0.28	1.79	N
DT 162	St Andrews St / Seagate (116)	R	340532	730548	NO <sub>2</sub>	Y	PDT	0.18	2.53	N
DT 59	Strathmore Avenue (353)	K	339609	731871	NO <sub>2</sub>	Y	PDT	1.45	0.67	N
DT 219	Thomson Avenue (Street Sign)	R	340542	730194	NO <sub>2</sub>	Y	PDT	1.80	2.20	N
DT 229	Thomson Avenue / S. Crichton St.	K	340421	730078	NO <sub>2</sub>	Y	PDT	3.05	0.86	N
DT 60	Trades Lane (31)	K	340575	730500	NO <sub>2</sub>	Y	PDT	1.82	0.44	N
DT 184	Victoria Rd (104) / William St	R	340697	730950	NO <sub>2</sub>	Y	PDT	1.50	1.36	N
DT 93	Victoria Rd (10b)	K	340230	730673	NO <sub>2</sub>	Y	PDT	2.70	0.30	N
DT 191	Victoria Rd (4) - India Buildings	R	340213	730633	NO <sub>2</sub>	Y	PDT	0	2.77	N
DT 68	Victoria Rd (60)	R	340375	730779	NO <sub>2</sub>	Y	PDT	0.56	2.18	N
DT 70	Victoria Rd/Hilltown	R	340274	730714	NO <sub>2</sub>	Y	PDT	2.01	1.15	N
DT 243	Victoria St (Eagle Mill)	R	340836	731026	NO <sub>2</sub>	Y	PDT	0.27	1.73	N
DT 71	Victoria St/Albert St	K	341071	731072	NO <sub>2</sub>	Y	PDT	1.70	0.75	N
DT 183	West Marketgait / Guthrie St	R	339805	730338	NO <sub>2</sub>	Y	PDT	2.02	1.16	N
DT 205	West Marketgait/ Old Mill (23)	R	339773	730436	NO <sub>2</sub>	Y	PDT	0.05	2.80	N

Site ID	Site Name	Site Type <sup>(1)</sup>	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA ? (Y/N)	Monitoring Technique	Distance to Relevant Exposure ? (m) <sup>(2)</sup>	Distance to Kerb of Nearest Road (m) <sup>(3)</sup>	Tube collocated with a Continuous Analyser ?
DT 231	West Marketgait/ Ward Road	R	339834	730314	NO <sub>2</sub>	Y	PDT	0	2.70	N
DT 72	Westport (2)	R	339842	730122	NO <sub>2</sub>	Y	PDT	2.50	0.46	N
DT 73	Whitehall Cr (4)	K	340376	730109	NO <sub>2</sub>	Y	PDT	3.00	0.88	N
DT 161	Whitehall Cr /Union St (50)	K	340305	730051	NO <sub>2</sub>	Y	PDT	4.78	0.64	N
DT 76	Whitehall St (1)	K	340265	730153	NO <sub>2</sub>	Y	PDT	5.57	0.88	N
DT 81	Whitehall St (12)	R	340293	730142	NO <sub>2</sub>	Y	PDT	2.67	3.00	N
DT 77	Whitehall St (15)	K	340322	730098	NO <sub>2</sub>	Y	PDT	4.55	0.75	N
DT 74	Whitehall St (40)	K	340330	730106	NO <sub>2</sub>	Y	PDT	3.57	0.78	N
DT 75	Whitehall St (5)	R	340289	730128	NO <sub>2</sub>	Y	PDT	3.17	2.51	N
DT 160	Whitehall St (Romon) Average	R	340278	730156	NO <sub>2</sub>	Y	PDT	1.66	3.49	Y
DT 82	Woodside Ave	UB	340776	732307	NO <sub>2</sub>	Y	PDT	n/a	0.55	N

**Notes:**

- a) R=Roadside, K=Kerbside, UB=Urban Background, 'Kerb' is taken as being the edge of the carriageway with flowing traffic.
- b) "0" if the monitoring site is at a location of exposure (e.g. installed on, adjacent to, or equivalent to the façade of a residential property, or is representative of a residential area).
- c) "n/a" if measurement not applicable (e.g.PDT at background or no relevant receptor at location).
- d) New sites first located in 2020 are highlighted in green. No new sites were located for 2021.
- e) Erratum - DCC Report APR2020 had incorrect x,y coordinates for DT235. These coordinates have been updated in this table.

Figure A.9a NO<sub>2</sub> Diffusion Tube Locations (City Centre)



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Figure A.9b NO<sub>2</sub> Diffusion Tube Locations (East)

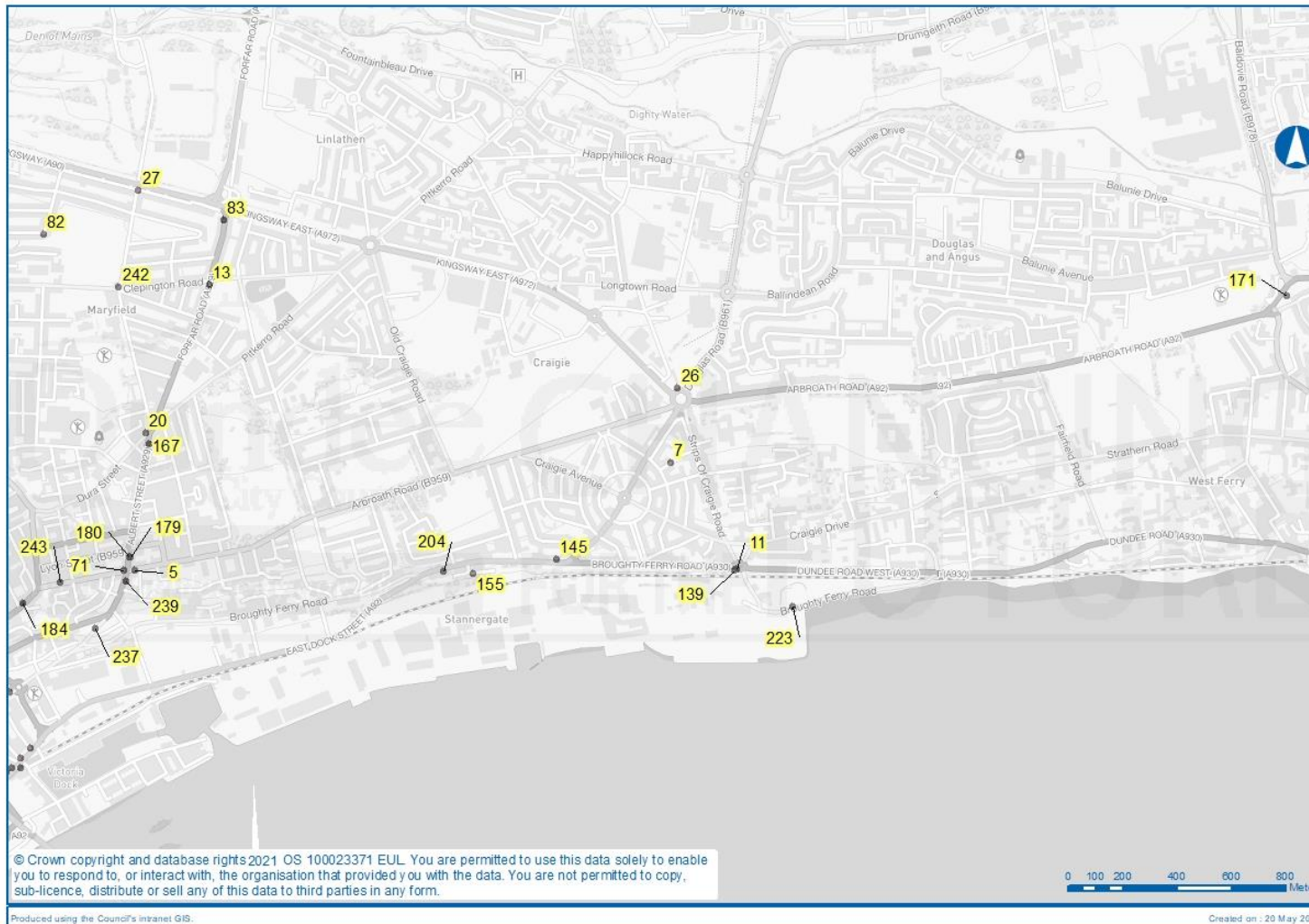
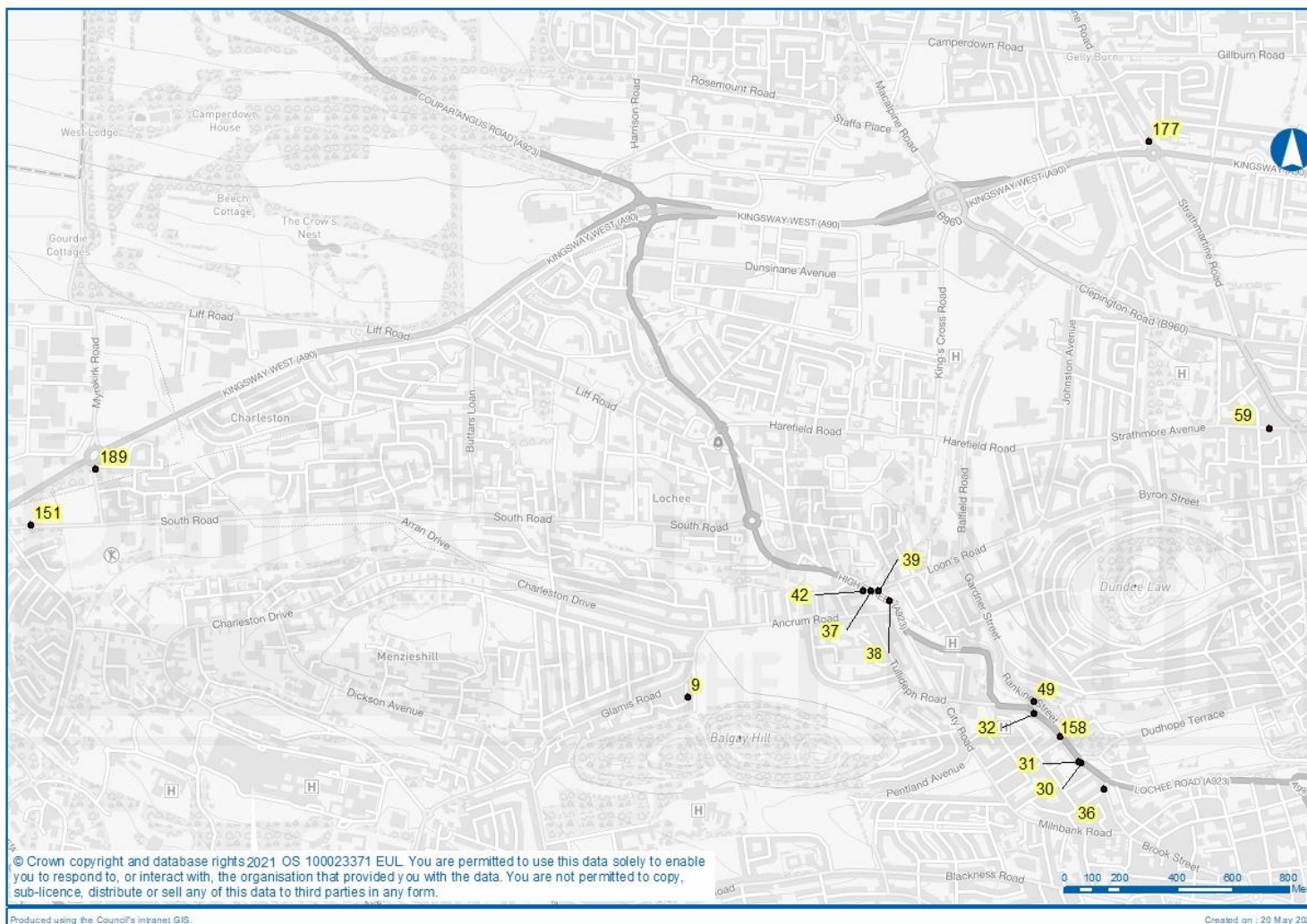


Figure A.9c NO<sub>2</sub> Diffusion Tube Locations (West)



NO<sub>2</sub> monitoring results – Annual MeanTable A.3 Annual Mean NO<sub>2</sub> Monitoring Results

Site ID.	Site Name	Site Type <sup>(1)</sup>	Monitoring Type	Valid Data Capture 2021 (%) <sup>(2)</sup>	NO <sub>2</sub> Annual Mean Concentration (µg/m <sup>3</sup> ) <sup>(3)</sup>				
					2017	2018	2019	2020	2021
DT 92	Abertay 2	R	PDT	91.7	35.9	37.9	36.5	26.2	29.8
DT 179	Albert St (15) (Facade)	R	PDT	100.0	31.5	33.2	30.3	24.5	24.1
DT 180	Albert St (15) (Rdside)	K	PDT	100.0	33.0	35.1	31.7	25.2	24.9
DT 167	Albert St (191)	K	PDT	100.0	30.1	32.5	30.6	20.8	23.6
DT 187	Albert St (81)	K	PDT		27.9	29.7	27.1		
DT 5	Arbroath Rd (13)	K	PDT	100.0	33.7	35.0	32.1	27.2	23.5
DT 147	Arbroath Rd (38)	K	PDT		34.3				
DT 7	Balgavies Place	UB	PDT	100.0	16.7	15.2	14.3	12.6	10.6
DT 9	Birnam Place	UB	PDT	100.0	9.9	9.3	8.5	6.5	6.7
DT 140	Broughty Ferry Rd (L/P 66)	R	PDT		33.5				
DT 164	Broughty Ferry Rd - Lower	UB	PDT		18.6				
DT 204	Broughty Ferry Rd (129)	R	PDT	100.0	38.2	40.1	37.0	27.0	26.8
DT 139	Broughty Ferry Rd (141 Downpipe)	R	PDT	100.0	34.0	31.1	30.1	24.4	24.1
DT 11	Broughty Ferry Rd (141)	R	PDT	100.0	40.0	36.4	36.3	26.7	26.8
DT 145	Broughty Ferry Rd (Greendykes)	R	PDT	91.7	34.1	33.6	32.2	24.7	25.4
CM 3	Broughty Ferry Road	UI	Automatic	52.5	19.7	23.3	22.9	19.6	12.9
DT 223	Broughty Ferry Road Lower (Cyclesign)	UB	PDT	83.3	24.4	20.2	22.0	19.1	14.2
DT 155	Carolina Court LP6	UB	PDT	100.0	20.4	19.7	19.4	15.7	14.6
DT 171	Claypotts / Arbroath Rd (502)	R	PDT	100.0	29.1	25.9	24.8	21.0	17.8
DT 232	Clepington Rd (164)	R	PDT				24.2		
DT 242	Clepington Rd / Mains Loan	R	PDT	100.0				16.4	14.9
DT 13	Clepington Rd/ Forfar Rd	K	PDT	100.0	30.6	30.6	29.4	21.7	22.1

Site ID.	Site Name	Site Type <sup>(1)</sup>	Monitoring Type	Valid Data Capture 2021 (%) <sup>(2)</sup>	NO <sub>2</sub> Annual Mean Concentration (µg/m <sup>3</sup> ) <sup>(3)</sup>				
					2017	2018	2019	2020	2021
DT 226	Commercial St (84)	R	PDT			26.2			
DT 188	Commercial St (9)	R	PDT	100.0	34.2	35.1	33.8	25.7	27.5
DT 84	Commercial St/Dock St (40)	R	PDT	100.0	34.3	33.1	31.6	24.7	25.8
DT 192	Dock St (12)	R	PDT		25.8	25.9			
DT 85	Dock St (21)	R	PDT	100.0	36.7	33.7	33.1	25.7	27.0
DT 156	Dock St (57)	R	PDT	100.0	49.4	46.4	44.2	32.6	34.8
DT 241	Dock St (Customs House)	R	PDT	100.0				27.8	27.2
DT 240	Dock St / Gellatly St	R	PDT	100.0				28.5	28.8
DT 233	Dock St/Trades Lane	R	PDT	83.3			33.5	27.8	27.0
DT 206	Drumgeith Road (2)	R	PDT		19.6				
DT 227	Dudhope Crescent Road (40)	K	PDT	100.0		39.3	38.8	28.9	29.6
DT 20	Dura St (100)	K	PDT	100.0	33.5	33.2	32.7	24.7	24.6
DT 214	East Dock Street (26)	R	PDT	100.0	31.8	31.6	32.9	27.1	27.8
DT 22	Eastport Roundabout	R	PDT	100.0	30.0	31.1	30.0	21.7	22.6
DT 83	Forfar Rd (104)	K	PDT	100.0	40.6	41.0	38.1	28.5	27.9
DT 225	Grays Lane (3)	R	PDT			21.4			
DT 221	Harcourt Street (CCTV)	R	PDT		17.8				
DT 216	King Street (3)	K	PDT		28.5	32.8			
DT 177	Kingsway / Strathmartine Rd (279)	R	PDT	100.0	32.0	33.7	28.7	23.2	22.8
DT 26	Kingsway East Roundabout	R	PDT	100.0	37.9	38.3	34.1	27.6	27.4
DT 27	Kingsway/ Mains Loan	R	PDT	100.0	27.6	28.4	27.5	20.5	21.3
DT 30	Lochee Rd (138)	K	PDT	91.7	47.3	48.4	45.8	39.0	34.9
DT 31	Lochee Rd (140) Traffic Lts	R	PDT	100.0	48.1	48.8	46.2	37.6	36.1
DT 32	Lochee Rd (184)	K	PDT	100.0	34.5	33.7	32.4	29.2	24.8
DT 158	Lochee Rd (Romon) Average	K	PDT	100.0	42.6	43.1	41.5	32.4	32.0
CM 4	Lochee Rd Romon	R	Automatic	99.7	43.6	43.4	43.0	31.2	31.7



Site ID.	Site Name	Site Type <sup>(1)</sup>	Monitoring Type	Valid Data Capture 2021 (%) <sup>(2)</sup>	NO <sub>2</sub> Annual Mean Concentration (µg/m <sup>3</sup> ) <sup>(3)</sup>				
					2017	2018	2019	2020	2021
DT 36	Lochee Rd/Polepark Rd	K	PDT	100.0	26.7	25.4	25.7	20.1	18.6
DT 37	Logie St (114)	R	PDT	100.0	47.9	48.2	47.1	40.9	38.6
DT 38	Logie St (98)	K	PDT	100.0	32.9	31.5	30.2	26.2	24.0
DT 39	Loons Rd (1)	R	PDT	100.0	35.6	35.5	35.1	28.9	29.8
DT 237	Lower Princess St	R	PDT	91.7			29.8	21.2	21.8
CM 12	Mains Loan	UB	Automatic	98.5	12.1	12.3	11.0	8.5	8.4
DT 182	Meadowside (28)	K	PDT		34.8	35.0			
DT 149	Meadowside (Romon) Average	R	PDT	100.0	39.3	40.4	37.7	27.9	28.1
DT 238	Meadowside Halls	R	PDT				28.4		
CM 14	Meadowside Romon	R	Automatic	81.0	34.8	34.3	33.9	25.6	27.1
DT 42	Muirton Rd (6)	R	PDT	100.0	23.4	25.0	24.1	19.0	19.7
DT 222	Muirton Road (2)	R	PDT		24.3	26.1			
DT 185	Murraygate (46)	UB	PDT	100.0	20.0	21.0	21.6	14.3	13.8
DT 189	Myrekirk Rd (29)	R	PDT	100.0	30.7	29.4	28.3	21.4	21.7
DT 47	Nethergate (40)	R	PDT	100.0	33.8	36.7	33.3	22.0	25.0
DT 45	Nethergate (6)	R	PDT	100.0	35.7	37.2	32.2	24.6	25.8
DT 213	Nethergate (64)	R	PDT	91.7	34.6	37.6	34.6	25.9	28.3
DT 44	Nethergate (88)	K	PDT	91.7	39.1	41.3	39.0	26.5	28.5
DT 46	Nethergate (95)	K	PDT	100.0	29.0	30.2	30.7	19.0	20.4
DT 48	Nethergate(132) / Marketgait	R	PDT	100.0	27.8	28.4	27.2	20.3	20.7
DT 207	Pitkerro Road (42)	R	PDT		32.5	33.0			
DT 239	Princes St (185)	K	PDT	100.0			39.9	30.6	30.8
DT 49	Rankine St (2)	R	PDT	100.0	39.3	38.5	36.7	28.6	25.9
DT 228	Riverside Esplanade / S. Crichton St.	R	PDT	100.0		29.1	25.4	20.6	21.4
CM 5	Seagate	R	Automatic	99.7	44.3	45.9	44.5	28.5	30.3
DT 50	Seagate (101)	R	PDT		35.5	38.3			

Site ID.	Site Name	Site Type <sup>(1)</sup>	Monitoring Type	Valid Data Capture 2021 (%) <sup>(2)</sup>	NO <sub>2</sub> Annual Mean Concentration (µg/m <sup>3</sup> ) <sup>(3)</sup>				
					2017	2018	2019	2020	2021
DT 224	Seagate (112)	R	PDT	91.7	34.1	37.6	37.1	29.1	27.9
DT 236	Seagate (36-40)	R	PDT	100.0			35.1	26.6	26.2
DT 54	Seagate (9)	R	PDT	100.0	30.3	29.5	28.8	21.3	22.4
DT 190	Seagate (97)	R	PDT	91.7	38.7	41.7	41.0	29.0	29.9
DT 217	Seagate (99)	R	PDT	100.0	42.5	41.3	37.9	28.3	29.3
DT 159	Seagate(Romon) Average	K	PDT	100.0	38.4	40.0	39.1	26.5	28.4
DT 55	Soapwork Lane	R	PDT	100.0	33.9	34.2	33.7	25.6	24.2
DT 218	South Marketgait (Lampost 18)	R	PDT	100.0	30.0	32.4	29.3	20.6	21.5
DT 235	South Marketgait/Nethergate	R	PDT	100.0			23.7	17.4	17.9
DT 151	South Rd (1 Denbank)	R	PDT	100.0	33.6	32.5	30.6	23.2	23.3
DT 56	St Andrews St (26)	K	PDT		29.0		26.2		
DT 162	St Andrews St PB (façade)	R	PDT	100.0	32.8	33.7	32.4	25.3	24.8
DT 220	Strathmartine Road (15)	R	PDT		17.7				
DT 59	Strathmore Avenue (353)	K	PDT	100.0	33.2	32.4	31.6	23.6	25.7
DT 219	Thomson Avenue (Street Sign)	R	PDT	100.0	31.1	31.6	30.3	22.7	22.3
DT 229	Thomson Avenue/S.Crichton St	K	PDT	100.0		28.9	27.9	21.7	21.2
DT 60	Trades Lane (31)	K	PDT	100.0	26.3	25.3	23.8	18.3	17.6
DT 184	Victoria Rd (104) / William St	R	PDT	100.0	27.4	28.4	27.2	20.2	21.3
DT 93	Victoria Rd (10b)	K	PDT	100.0	29.8	31.5	31.3	24.8	24.9
DT 191	Victoria Rd (4) - India Buildings	R	PDT	100.0	28.6	29.3	28.9	21.9	22.9
DT 68	Victoria Rd (60)	R	PDT	100.0	33.0	33.4	33.0	26.8	26.3
DT 70	Victoria Rd/Hilltown	R	PDT	100.0	51.5	49.2	48.3	38.0	40.6
DT 243	Victoria St (Eagle Mill)	R	PDT	100.0				16.2	15.3
DT 71	Victoria St/Albert St	K	PDT	100.0	28.0	28.0	26.8	21.8	20.6
DT 183	West Marketgait / Guthrie St	R	PDT	100.0	44.1	41.4	38.3	34.0	32.7
DT 231	West Marketgait/ Ward Road	R	PDT	100.0		31.2	33.5	24.5	23.5

Site ID.	Site Name	Site Type <sup>(1)</sup>	Monitoring Type	Valid Data Capture 2021 (%) <sup>(2)</sup>	NO <sub>2</sub> Annual Mean Concentration (µg/m <sup>3</sup> ) <sup>(3)</sup>				
					2017	2018	2019	2020	2021
DT 205	West Marketgait/Old Mill (23)	R	PDT	100.0	<b>45.1</b>	<b>47.0</b>	<b>47.1</b>	<b>36.1</b>	<b>36.5</b>
DT 72	Westport (2)	R	PDT	100.0	33.1	31.5	28.4	19.9	17.6
DT 73	Whitehall Cr (4)	K	PDT	100.0	33.2	32.3	30.7	23.6	23.4
DT 161	Whitehall Cr /Union St (50)	K	PDT	100.0	24.4	24.1	23.2	16.9	16.7
DT 76	Whitehall St (1)	K	PDT	91.7	<b>40.9</b>	<b>42.5</b>	<b>40.3</b>	31.8	33.0
DT 81	Whitehall St (12)	R	PDT	100.0	34.5	<b>38.4</b>	35.4	27.9	28.9
DT 77	Whitehall St (15)	K	PDT	100.0	31.8	32.9	31.0	22.9	23.6
DT 74	Whitehall St (40)	K	PDT	100.0	33.7	<b>36.8</b>	33.4	24.9	27.8
DT 75	Whitehall St (5)	R	PDT	100.0	<b>39.5</b>	<b>39.3</b>	35.8	27.7	27.5
DT 160	Whitehall St (Romon) Average	R	PDT	100.0	35.0	<b>38.3</b>	34.6	23.8	27.2
CM 6	Whitehall St Romon	R	Automatic	99.7	35.3	<b>37.5</b>	33.4	24.0	27.5
DT 82	Woodside Ave	UB	PDT	100.0	13.3	13.4	11.4	9.1	8.5

**Notes:** Exceedences of the NO<sub>2</sub> annual mean objective of 40µg/m<sup>3</sup> are shown in **bold**. Borderline values are shown in **orange**.  
 NO<sub>2</sub> annual means exceeding 60µg/m<sup>3</sup>, indicating a potential exceedence of the NO<sub>2</sub> 1-hour mean objective are shown in **bold and underlined**.

(1) R=Roadside, K=Kerbside, UB=Urban Background

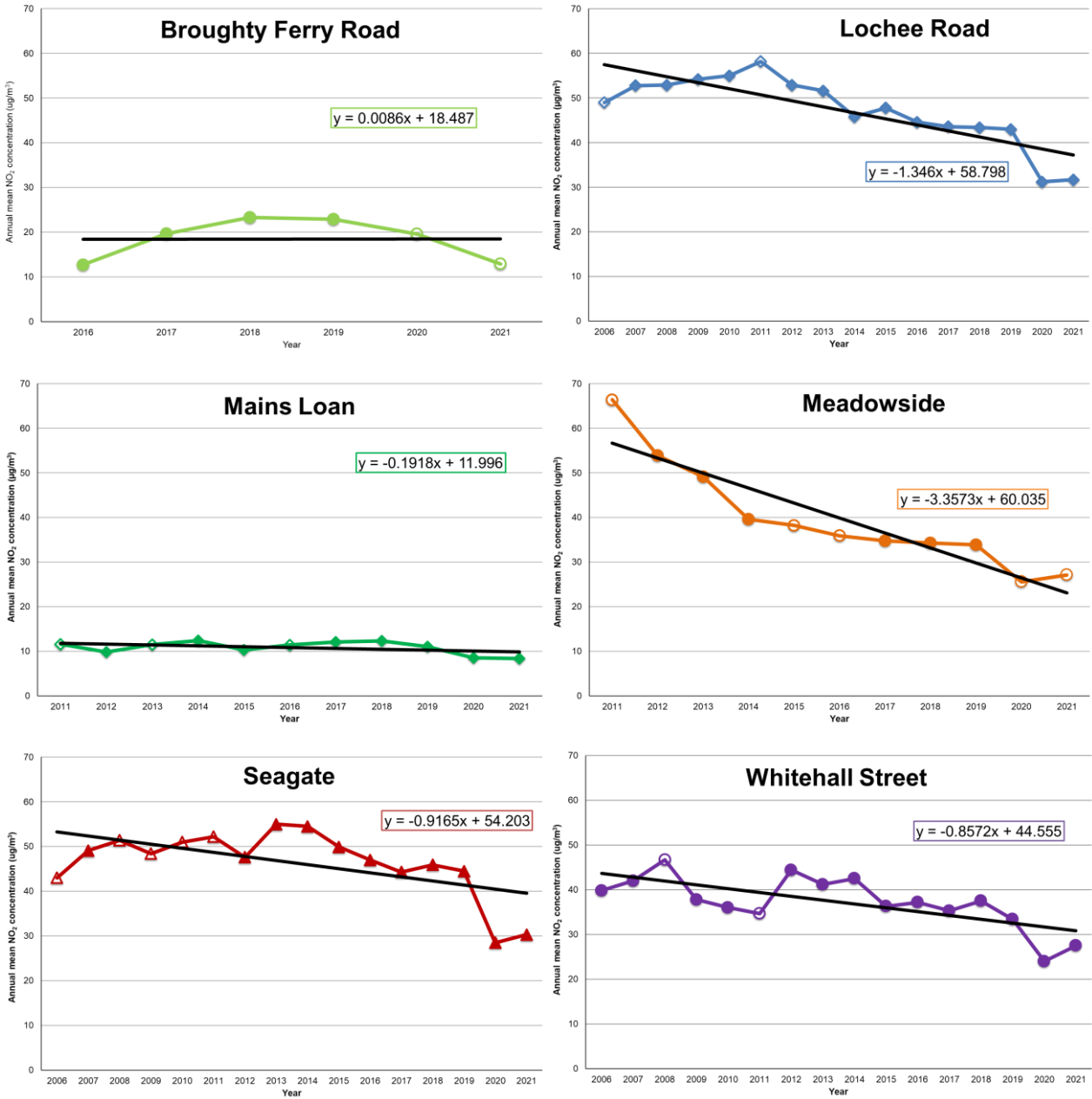
(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) Means for diffusion tubes have been corrected for bias.

All means have been “annualised” as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75% (highlighted by shading). See **Appendix C** for details.

**NO<sub>2</sub> monitoring results – Annual Means Trends**

**Figure A.10a Trends in Annual Mean NO<sub>2</sub> at Automatic monitors**



**Notes:**

- 1) Graphs show the trends in the NO<sub>2</sub> annual mean concentrations measured at the continuous monitors (other locations nearby may have higher concentrations.)
- 2) A minimum of five years data is required to show a valid trend. More years (data points) give greater certainty in the trend.
- 3) For strict comparison with the annual mean objective of 40µg/m<sup>3</sup>, data capture should be greater than 85%. Annual means where data capture were below 85% are shown by a 'hollow' marker.
- 4) Means have been "annualised" as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75%. See **Appendix C** for details.

Figure A.10b Trend Analysis at Long-term NO<sub>2</sub> Monitoring Locations

Site Id.	Location	Site Type	No. of years for trend	Trend	Site Id.	Location	Site Type	No. of years for trend	Trend
DT 217	Seagate (99)	R	5	-3.942	DT 30	Lochee Rd (138)	K	16	-0.940
CM 14	Meadowside	R	11	-3.357	DT 68	Victoria Rd (60)	R	16	-0.929
DT 190	Seagate (97)	R	9	-2.955	CM 5	Seagate	R	16	-0.916
DT 205	<b>West Marketgait/Old Mill (23)</b>	R	7	-2.911	DT 31	<b>Lochee Rd (140) Traffic Lts</b>	R	16	-0.902
DT 218	South Marketgait (Lampost 18)	R	5	-2.890	DT 47	Nethergate (40)	R	16	-0.895
DT 149	Meadowside (Romon) Average	R	11	-2.749	DT 84	Commercial St/Dock St (40)	R	16	-0.888
DT 219	Thomson Avenue (Street Sign)	R	5	-2.660	DT 5	Arbroath Rd (13)	K	16	-0.883
DT 213	Nethergate (64)	R	6	-2.272	DT 158	Lochee Rd (Romon) Average	K	16	-0.871
DT 183	West Marketgait / Guthrie St	R	9	-2.162	DT 71	Victoria St/Albert St	K	16	-0.858
DT 223	Broughty Ferry Road Lower (Cyclesign)	UB	5	-2.161	CM 6	Whitehall Street	R	16	-0.857
DT 224	Seagate (112)	R	5	-2.089	DT 20	Dura St (100)	K	16	-0.856
DT 171	Claypotts / Arbroath Rd (502)	R	7	-1.988	DT 145	Broughty Ferry Rd (Greendykes)	R	11	-0.851
DT 177	Kingsway / Strathmartine Rd (279)	R	9	-1.985	DT 11	Broughty Ferry Rd (141)	R	16	-0.843
DT 204	Broughty Ferry Rd (129)	R	7	-1.919	DT 27	Kingsway/ Mains Loan	R	16	-0.828
DT 188	Commercial St (9)	R	9	-1.817	DT 59	Strathmore Avenue (353)	K	16	-0.814
DT 180	Albert St (15) (Rdside)	K	9	-1.652	DT 48	Nethergate(132) / Marketgait	R	16	-0.813
DT 167	Albert St (191)	K	9	-1.610	DT 37	<b>Logie St (114)</b>	R	16	-0.807
DT 189	Myrekirk Rd (29)	R	9	-1.590	DT 77	Whitehall St (15)	K	16	-0.772
DT 179	Albert St (15) (Facade)	R	9	-1.539	DT 45	Nethergate (6)	R	16	-0.764
DT 161	Whitehall Cr /Union St (50)	K	10	-1.527	DT 39	Loons Rd (1)	R	16	-0.733
DT 156	Dock St (57)	R	11	-1.519	DT 36	Lochee Rd/Polepark Rd	K	16	-0.704
DT 162	St Andrews St PB (façade)	R	10	-1.426	DT 26	Kingsway East Roundabout	R	16	-0.677
DT 214	East Dock Street (26)	R	6	-1.352	DT 155	Carolina Court LP6	UB	10	-0.658
DT 184	Victoria Rd (104) / William St	R	9	-1.348	DT 22	Eastport Roundabout	R	16	-0.653
CM 4	Lochee Road	R	16	-1.347	DT 49	Rankine St (2)	R	16	-0.640
DT 185	Murraygate (46)	UB	9	-1.275	DT 32	Lochee Rd (184)	K	16	-0.595
DT 75	Whitehall St (5)	R	16	-1.224	DT 76	Whitehall St (1)	K	16	-0.588
DT 159	Seagate(Romon) Average	K	16	-1.219	DT 160	Whitehall St (Romon) Average	R	16	-0.587
DT 92	Abertay 2	R	13	-1.213	DT 85	Dock St (21)	R	16	-0.581
DT 191	Victoria Rd (4) - India Buildings	R	9	-1.188	DT 82	Woodside Ave	UB	16	-0.569
DT 72	Westport (2)	R	16	-1.178	DT 42	Muirton Rd (6)	R	16	-0.555
DT 151	South Rd (1 Denbank)	R	11	-1.126	DT 81	Whitehall St (12)	R	16	-0.534
DT 54	Seagate (9)	R	16	-1.100	DT 38	Logie St (98)	K	16	-0.485
DT 139	Broughty Ferry Rd (141 Downpipe)	R	11	-1.081	DT 74	Whitehall St (40)	K	16	-0.396
DT 46	Nethergate (95)	K	16	-1.059	DT 55	Soapwork Lane	R	16	-0.382
DT 83	Forfar Rd (104)	K	16	-1.056	DT 7	Balgavies Place	UB	16	-0.363
DT 44	Nethergate (88)	K	16	-0.975	DT 9	Bimam Place	UB	16	-0.243
DT 93	Victoria Rd (10b)	K	13	-0.969	CM 12	Mains Loan	UB	11	-0.192
DT 60	Trades Lane (31)	K	16	-0.952	DT 73	Whitehall Cr (4)	K	16	-0.105
DT 13	Cleington Rd/ Forfar Rd	K	16	-0.950	CM 3	Broughty Ferry Rd	UI	6	0.009
DT 70	<b>Victoria Rd/Hilltown</b>	R	16	-0.944					

**Note:**

- (1) Locations where the 2021 NO<sub>2</sub> annual mean is exceeded at the monitor are shown in **bold red**, borderline locations are orange
- (2) Blue is an improving trend, red is a worsening trend
- (3) Methodology explained after **Figure A.12c**

**NO<sub>2</sub> monitoring results – 1-hour mean**

**Table A.4 1-hour Mean NO<sub>2</sub> Monitoring Results, Number of 1-hour Means >200ug/m<sup>3</sup>**

Site ID.	Site Name	Site Type <sup>(1)</sup>	Monitoring Type	Valid Data Capture 2021 (%) <sup>(2)</sup>	NO <sub>2</sub> 1-Hour Means > 200µg/m <sup>3</sup> <sup>(3)</sup>				
					2017	2018	2019	2020	2021
CM3	Broughty Ferry Rd	UI	Automatic	52.5	0	0	0	0 (61.1)	0 (61.9)
CM4	Lochee Rd Romon	R	Automatic	99.7	6	6	2	0	0
CM12	Mains Loan	UB	Automatic	98.5	1	0	0	0	0
CM14	Meadowside Romon	R	Automatic	81.0	0	0	0	0 (95.1)	0 (107.2)
CM5	Seagate	R	Automatic	99.7	0	0	0	0	0
CM6	Whitehall St Romon	R	Automatic	99.7	0	0	0	0	0

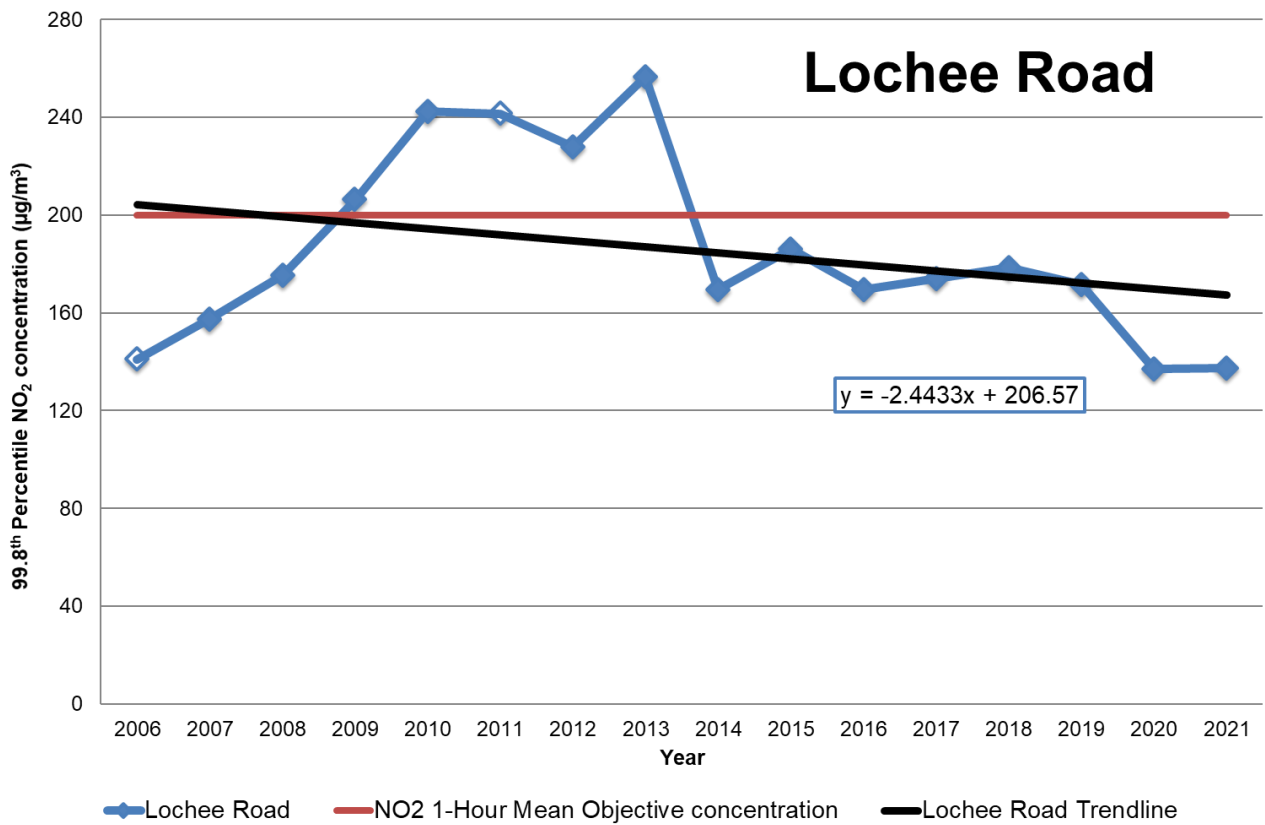
**Notes:** Exceedences of the NO<sub>2</sub> 1-hour mean objective (200µg/m<sup>3</sup> not to be exceeded more than 18 times/year) are shown in **bold**.

(1) R=Roadside, K=Kerbside, UB=Urban Background, UI=Urban Industrial

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets (and shaded grey).

Figure A.11 Trend in 99.8th percentile of hourly mean NO<sub>2</sub> concentrations at Lochee Road



PM<sub>10</sub> monitoring results – Annual Mean

Table A.5 Annual Mean PM<sub>10</sub> Monitoring Results

Site ID	Site Name	Site Type <sup>(1)</sup>	Monitoring Type	Valid Data Capture 2021 (%) <sup>(2)</sup>	PM <sub>10</sub> Annual Mean Concentration (µg/m <sup>3</sup> ) <sup>(3)</sup>				
					2017	2018	2019	2020	2021
CM 4	Lochee Rd (BAM/Fidas)	R	Automatic	99.7	17.5	12.6	11.8	9.8	10.7
CM 5	Seagate (BAM/Fidas)	R	Automatic	99.7	15.8	15.6	13.7	9.6	11.0
CM 14	Meadowside (BAM/Fidas)	R	Automatic	96.2	14.7	15.3	14.1	9.1	10.1
CM 6	Whitehall Street (BAM/Fidas)	R	Automatic	99.7	14.7	15.7	11.9	7.9	8.3
CM 12	Mains Loan (TEOM/Fidas)	UB	Automatic	98.9	9.5	9.1	9.2	7.0	7.5
CM 3	Broughty Ferry Rd (TEOM/Fidas)	UI	Automatic	85.8	11.4	12.3*	13.6	8.9	10.1
CM 13	Broughty Ferry Rd (Partisol)	UI	Automatic	64.7	11.1	11.2	11.3	10.0*	10.2*
CM 16	Broughty Ferry Rd (Osiris)	UI	Automatic	63.6	11.1	11.3*	11.2	9.7	9.9*
CM 9	Logie St (Osiris)	K	Automatic	79.1	14.5	18.9	15.4*	14.0*	11.4*
CM 17	Myrekirk Tce (Osiris)	R	Automatic	76.8	12.0	13.5	12.3*	11.0	12.8*
CM 15	Albert St (Osiris)	K	Automatic	88.7	14.3	17.5*	15.1	13.9*	11.1
CM 18	Stannergate (Osiris)	R	Automatic	64.3	14.0	11.9*	13.3*	11.5	16.4*

Notes: Exceedences of the PM<sub>10</sub> annual mean objective of 18µg/m<sup>3</sup> are shown in **bold** (borderline values are orange).

(1) R=Roadside, K=Kerbside, UB=Urban Background, UI=Urban Industrial

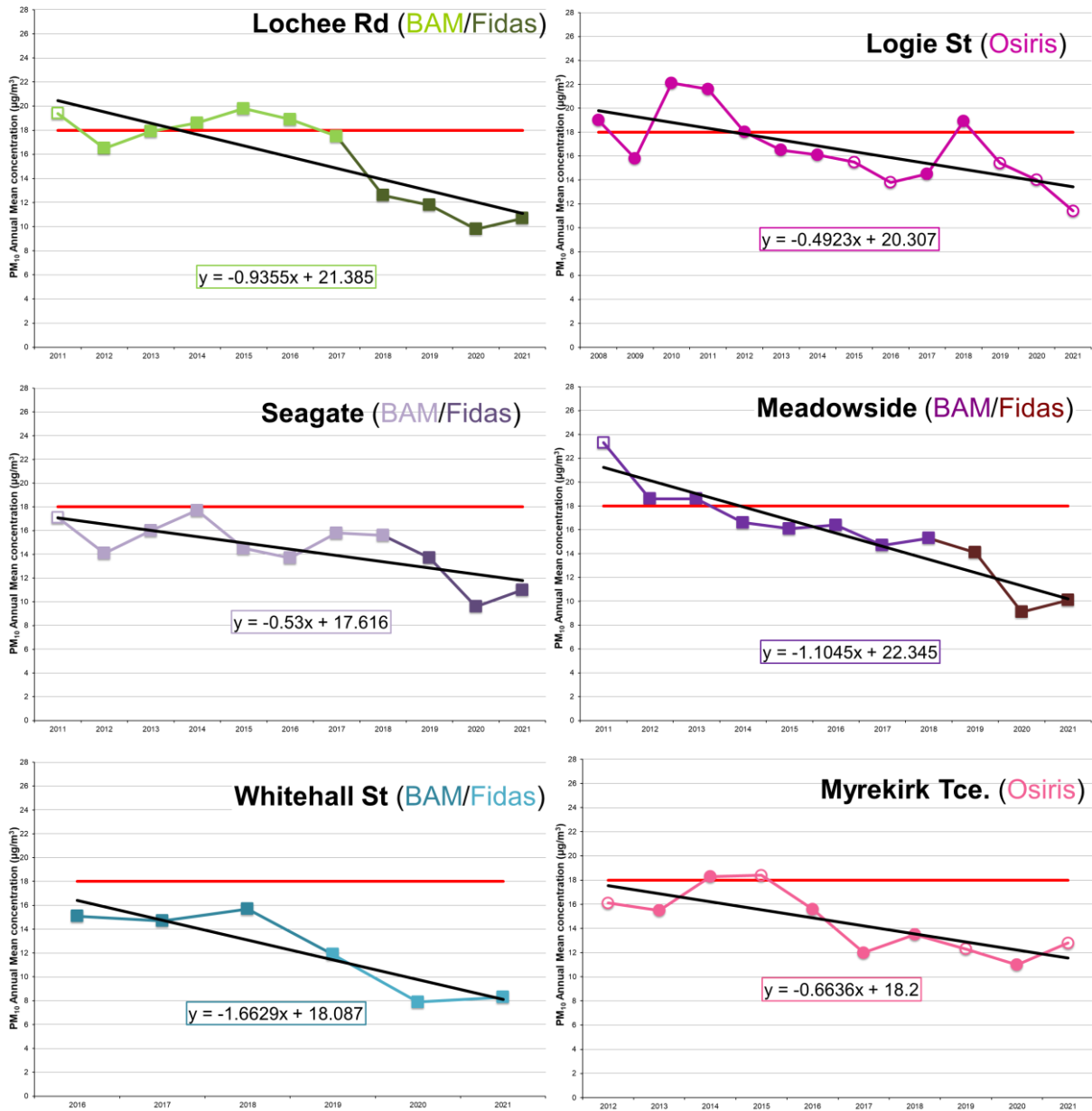
(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%). \* indicates data capture less than 85%

(3) All means have been “annualised” as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75% (highlighted by shading). See Appendix C for details.



PM<sub>10</sub> monitoring results – Annual Means trends

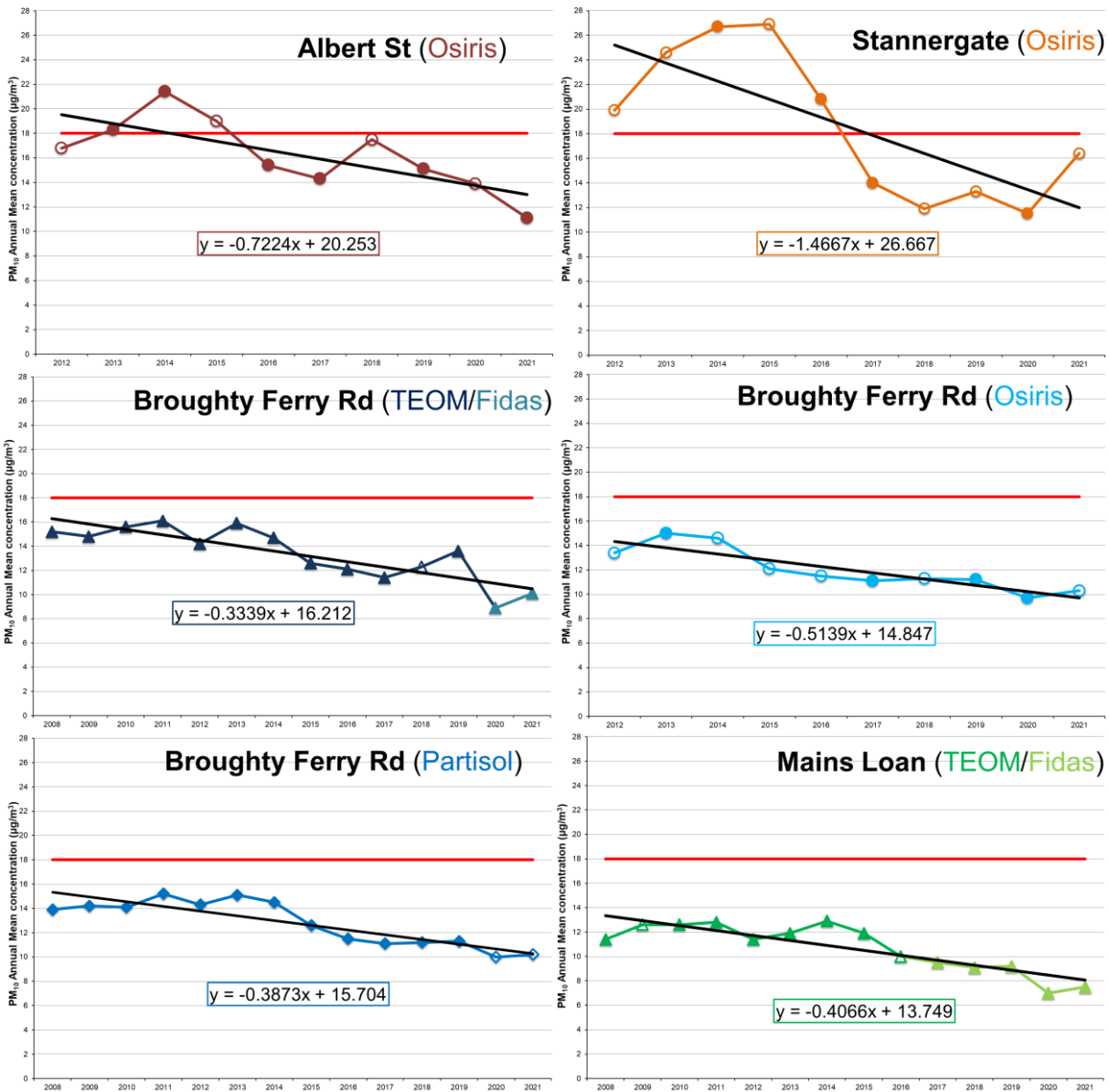
Figure A.12a Trends in Annual Mean PM<sub>10</sub> concentrations at Automatic monitors



Notes:

- 1) Graphs show the trends (black lines) in the PM<sub>10</sub> annual mean concentrations measured at the continuous analysers.
- 2) A minimum of five years data is required to show a valid trend. More years (data points) give greater certainty in the trend.
- 3) The trend line equation is shown. Decreasing trends have a negative "x" value, increasing trends a positive "x" value.
- 4) For strict comparison with the annual mean objective of 18µg/m<sup>3</sup>(shown by the red line), data capture should be greater than 85%. Annual means where data capture were below 85% are shown by a 'hollow' marker.
- 5) Means have been "annualised" as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75%. See **Appendix C** for details.

Figure A.12b Trends in Annual Mean PM<sub>10</sub> concentrations at Automatic Monitors



Notes:

**Notes:**

- 1) Graphs show the trends (black lines) in the PM<sub>10</sub> annual mean concentrations measured at the continuous analysers.
- 2) A minimum of five years data is required to show a valid trend. More years (data points) give greater certainty in the trend.
- 3) The trend line equation is shown. Decreasing trends have a negative "x" value, increasing trends a positive "x" value.
- 4) For strict comparison with the annual mean objective of 18µg/m<sup>3</sup>(shown by the red line), data capture should be greater than 85%. Annual means where data capture were below 85% are shown by a 'hollow' marker.
- 5) Means have been "annualised" as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75%. See **Appendix C** for details.

Figure A.12c Trend analysis of PM<sub>10</sub> annual means at long term monitoring sites

Site Id.	Location <sup>(1,2)</sup>	No. of years for trend	Trend <sup>(3)</sup>
CM 6	Whitehall St (BAM/Fidas)	6	-1.663
CM 18	Stannergate (Osiris)	10	-1.467
CM 14	Meadowside (BAM/Fidas)	11	-1.105
CM 4	Lochee Rd (BAM/Fidas)	11	-0.935
CM 15	Albert St (Osiris)	10	-0.722
CM 17	Myrekirk Tce (Osiris)	10	-0.664
CM 5	Seagate (BAM/Fidas)	11	-0.530
CM 16	Broughty Ferry Rd (Osiris)	10	-0.514
CM 9	Logie St (Osiris)	14	-0.492
CM 3	Broughty Ferry Rd (TEOM/Fidas)	14	-0.447
CM 12	Mains Loan (TEOM/Fidas)	14	-0.407
CM 13	Broughty Ferry Rd (Partisol)	14	-0.387

**Notes:** (1) Locations where the 2020 PM<sub>10</sub> annual mean is exceeded are shown in **bold**, borderline locations are **orange**  
 (2) Locations shaded grey had less than 75% data capture in 2020, so the annual mean was "annualised"  
 (3) **Blue** is an improving trend, **red** a worsening trend.

Explanation of Methodology for **Figures A.10b** and **A.12c** have been generated using the LINEST function in Microsoft Excel. This function can be used to return a value that describes the slope of a best fit straight line for a number of points (in this case 5 or more values) i.e. simple linear regression. A negative value denotes a downwards slope hence an improving trend and, a positive value denotes an upwards slope or worsening trend. The magnitude of the number generated by the LINEST function can be used to compare the magnitude of the (improving or worsening) trend.

PM<sub>10</sub> monitoring results – Daily mean

Table A.6 24-hour Mean PM<sub>10</sub> Monitoring Results, Number of PM<sub>10</sub> 24-hour Means >50ug/m<sup>3</sup>

Site ID	Site Name	Site Type <sup>(1)</sup>	Monitoring Type	Valid Data Capture 2020 (%) <sup>(2)</sup>	PM <sub>10</sub> 24-Hour Means > 50µg/m <sup>3</sup> <sup>(3)</sup>				
					2017	2018	2019	2020	2021
CM 4	Lochee Rd (BAM/Fidas)	R	Automatic	86.3	4	1	1	0	0
CM 5	Seagate (BAM/Fidas)	R	Automatic	100.0	3	1	1	0	0
CM 14	Meadowside (BAM/Fidas)	R	Automatic	99.2	1	4	3 (43.4)	0	0
CM 6	Whitehall Street (BAM/Fidas)	R	Automatic	99.5	1	4 (39.8)	1	0	0
CM 12	Mains Loan (TEOM/Fidas)	UB	Automatic	100.0	0	0	1	0	0
CM 3	Broughty Ferry Rd (TEOM/Fidas)	UI	Automatic	100.0	0	0 (25.6)	1	0	0
CM 13	Broughty Ferry Rd (Partisol)	UI	Automatic	76.6	0	0	0	0 (24.5)	0 (21.8)
CM 16	Broughty Ferry Rd (Osiris)	UI	Automatic	87.2	0	1 (34.2)	1	0	0 (22.8)
CM 9	Logie St (Osiris)	K	Automatic	71.3	2	<b>11</b>	3 (41.1)	0 (30.3)	1 (25.7)
CM 17	Myrekirk Tce (Osiris)	R	Automatic	88.5	0	2	1 (39.7)	0	0 (27.0)
CM 15	Albert St (Osiris)	K	Automatic	69.9	3	5 (46.0)	7	0 (38.5)	0
CM 18	Stannergate (Osiris)	R	Automatic	88.5	2	0 (25.7)	1 (32.9)	0	3 (43.9)

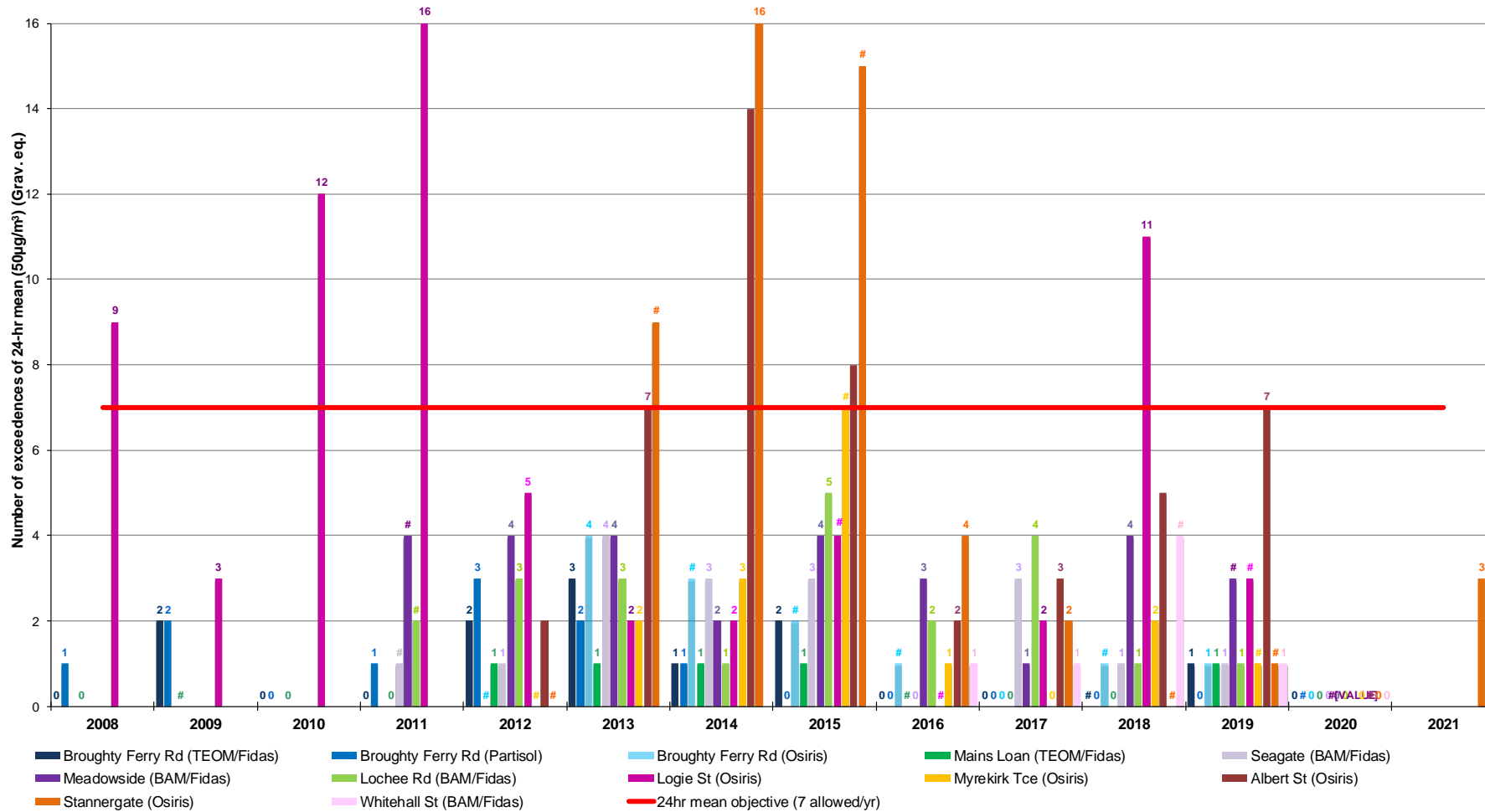
**Notes:** Exceedences of the PM<sub>10</sub> 24-hour mean objective (50µg/m<sup>3</sup> not to be exceeded more than 7 times/year) are shown in **bold**.

(1) R=Roadside, K=Kerbside, UB=Urban Background, UI= Urban Industrial

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 98.08th percentile of 24-hour means is provided in brackets (and shaded grey).

Figure A.13 24-hour mean PM<sub>10</sub> concentrations greater than 50ug/m<sup>3</sup>



PM<sub>2.5</sub> monitoring results – Annual Mean

Table A.7 Annual Mean PM<sub>2.5</sub> Monitoring Results (ug/m<sup>3</sup>)

Site ID	Site Name	Site Type <sup>(1)</sup>	Monitoring Type	Valid Data Capture 2021 (%) <sup>(2)</sup>	PM <sub>2.5</sub> Annual Mean Concentration (µg/m <sup>3</sup> ) <sup>(3)(4)</sup>				
					2017	2018	2019	2020	2021
CM 3	Broughty Ferry Rd (Fidas)	UI	Automatic	85.8	n/a	n/a	n/a	4.4	4.9
CM 4	Lochee Rd (Fidas)	R	Automatic	99.7	n/a	5.7	6.4	5.2	5.7
CM 5	Seagate (Fidas)	R	Automatic	99.7	n/a	5.5	6.9*	5.0	5.7
CM 14	Meadowside (Fidas)	R	Automatic	96.2	n/a	n/a	6.6*	4.6	5.3
CM 6	Whitehall Street (Fidas)	R	Automatic	99.7	n/a	n/a	6.3*	4.3	4.7
CM 12	Mains Loan (Fidas)	UB	Automatic	98.9	n/a	5.5	5.5	4.1	4.4

**Notes:** Exceedences of the PM<sub>2.5</sub> annual mean objective of 10µg/m<sup>3</sup> are shown in **bold** (borderline values are orange).

(1) R=Roadside, K=Kerbside, UB=Urban Background, UI=Urban Industrial

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been “annualised” as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75% (highlighted by shading). See **Appendix C** for details.

(4) \* indicates data capture less than 85%

## Appendix B: Full Monthly Diffusion Tube Results for 2021

Table B.1 NO<sub>2</sub> Monthly Diffusion Tube Results for 2021

Site Id. (DT)	Location	x	y	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Mean	% Data	Period Adj <sup>*</sup> Factor	Annual Mean	Annual mean Bias (0.85)
92	Abertay 2	340019	730612	33.3	32.7	26.9	30.2	34.1	M	35.4	37.3	41.8	39.5	36.8	38.1	35.1	91.7	1.0	35.1	29.8
179	Albert St (15)(Façade)	341092	731121	33.9	28.5	21.5	29.2	32.1	20.6	29.4	31.2	31.7	26.5	25.7	30.6	28.4	100.0	1.0	28.4	24.1
180	Albert St (15)(Roadside)	341091	731121	37.1	29.3	21.5	30.4	33.8	20.9	29.7	28.6	32.3	29.9	28.0	29.9	29.3	100.0	1.0	29.3	24.9
167	Albert St (191)	341161	731535	32.7	33.0	21.1	28.4	32.9	19.9	27.3	27.7	28.5	25.7	22.8	32.7	27.7	100.0	1.0	27.7	23.6
5	Arbroath Rd (13)	341111	731070	33.9	29.3	27.3	24.1	23.1	22.1	20.5	22.2	31.1	34.8	32.6	30.9	27.7	100.0	1.0	27.7	23.5
223	B/ Ferry Rd Lower (Cyclesign)	343530	730937	25.4	17.7	21.9	12.4	M	8.2	M	7.3	14.8	18.9	22.0	18.3	16.7	83.3	1.0	16.7	14.2
204	B/Ferry Rd (129)	342244	731066	40.6	28.3	25.6	27.5	33.7	24.7	28.3	28.3	27.8	34.1	37.4	41.9	31.5	100.0	1.0	31.5	26.8
139	B/Ferry Rd (141) Downpipe	343317	731072	32.8	26.1	37.4	23.2	18.8	22.3	18.5	20.0	29.8	35.4	40.6	35.2	28.3	100.0	1.0	28.3	24.1
145	B/Ferry Rd Greendykes	342662	731112	30.8	26.0	29.2	24.2	25.2	23.4	23.2	24.6	M	40.5	43.9	38.2	29.9	91.7	1.0	29.9	25.4
7	Balgavies Pl	343082	731465	18.9	14.9	14.8	10.6	7.1	7.8	6.3	7.5	10.6	16.2	16.0	18.9	12.5	100.0	1.0	12.5	10.6
9	Birnam Pl	337531	730914	12.2	10.0	7.4	6.3	6.3	4.2	4.7	5.9	6.6	9.0	10.0	11.5	7.8	100.0	1.0	7.8	6.7
11	Broughty Ferry Rd (141)	343322	731073	36.7	28.0	39.0	24.9	24.3	25.3	23.7	27.6	33.9	33.8	42.1	39.2	31.5	100.0	1.0	31.5	26.8
155	Carolina Court Lp6	342353	731058	24.0	18.8	17.4	14.5	12.1	12.6	9.8	11.2	15.4	22.0	22.9	25.2	17.2	100.0	1.0	17.2	14.6
171	Claypotts / Arbroath Rd (502)	345347	732080	32.2	22.4	20.4	19.6	12.7	13.1	10.3	13.2	16.9	25.0	33.2	32.1	20.9	100.0	1.0	20.9	17.8
13	Clelington Rd/ Forfar Rd	341385	732121	36.4	26.0	24.9	28.0	22.8	18.8	17.7	18.5	24.1	29.7	31.6	33.0	26.0	100.0	1.0	26.0	22.1
242	Clelington Rd/ Mains Loan	341050	732111	25.9	18.0	15.0	15.7	15.7	11.2	12.3	14.5	16.1	19.6	21.9	24.5	17.5	100.0	1.0	17.5	14.9
188	Commercial St (9)	340544	730291	36.3	32.5	26.8	33.2	29.8	24.1	34.6	31.1	32.5	32.5	36.4	39.0	32.4	100.0	1.0	32.4	27.5
84	Commercial St /Dock St (40)	340565	730263	36.0	31.6	26.3	29.3	26.2	23.5	26.6	28.3	31.7	33.9	36.0	35.4	30.4	100.0	1.0	30.4	25.8
85	Dock St (21)	340524	730216	39.9	31.4	27.4	30.9	29.2	23.7	28.6	28.3	30.3	33.8	39.1	37.9	31.7	100.0	1.0	31.7	27.0

Site Id. (DT)	Location	x	y	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Mean	% Data	Period Adj' Factor	Annual Mean	Annual mean Bias (0.85)
156	Dock St (57)	340656	730343	48.2	37.3	39.4	37.9	35.1	35.0	33.1	35.3	43.8	48.1	57.0	40.5	<b>40.9</b>	100.0	1.0	<b>40.9</b>	34.8
241	Dock St (Customs House)	340691	730344	32.4	31.1	24.5	31.2	33.3	25.3	32.0	30.9	36.7	33.4	35.5	37.9	32.0	100.0	1.0	32.0	27.2
240	Dock St/Gellatly St	340638	730328	39.4	33.1	27.7	32.0	31.1	26.4	31.9	29.2	33.8	38.0	42.3	41.1	33.8	100.0	1.0	33.8	28.8
233	Dock St/Trades Lane	340690	730382	35.9	30.6	M	27.9	31.6	26.4	26.8	M	33.8	32.5	35.6	36.2	31.7	83.3	1.0	31.7	27.0
227	Dudhope Crescent Road (40)	339830	730619	42.3	31.0	32.8	30.6	31.9	22.2	25.6	25.9	35.5	41.2	51.3	47.0	34.8	100.0	1.0	34.8	29.6
20	Dura St (100)	341150	731576	37.4	28.6	25.9	29.8	26.6	21.2	23	24.1	30.6	31.1	36.7	33.3	29.0	100.0	1.0	29.0	24.6
214	East Dock St (26)	340725	730417	39.0	32.6	28.5	32.8	34.5	26.8	29.0	29.5	34.1	35.8	36.4	33.9	32.7	100.0	1.0	32.7	27.8
22	Eastport Roundabout	340651	730623	33.1	26.0	22.9	35.1	26.6	16.7	22.2	23.8	24.1	27.8	30.6	29.6	26.5	100.0	1.0	26.5	22.6
83	Forfar Rd (104)	341437	732360	37.6	30.8	31.4	30.1	28.6	28.9	26.0	28.5	35.4	38.4	39.9	38.8	32.9	100.0	1.0	32.9	27.9
26	Kingsway East Roundabout	343107	731740	35.1	33.5	26.2	30.2	30.7	25.8	29.1	29.7	37.6	40.1	40.1	29.3	32.3	100.0	1.0	32.3	27.4
27	Kingsway/ Mains Loan	341124	732468	33.4	28.3	19.1	28.1	29.3	16.2	25.8	25.9	22.6	20.8	22.3	28.2	25.0	100.0	1.0	25.0	21.3
177	Kingsway/Strathmartine Rd (N)	339179	732896	33.8	28.8	24.7	22.5	22.2	19.7	20.7	21.5	23.0	35.3	34.3	35.6	26.8	100.0	1.0	26.8	22.8
30	Lochee Rd (138)	338936	730680	52.5	34.7	41.1	39.4	37.8	31.6	32.9	34.5	43.0	M	54.5	49.3	<b>41.0</b>	91.7	1.0	<b>41.0</b>	34.9
31	Lochee Rd (140)(Traffic Lts)	338927	730685	51.5	39.5	42.1	39.2	41.4	31.8	37.9	39.4	45.0	44.6	50.3	46.4	<b>42.4</b>	100.0	1.0	<b>42.4</b>	<b>36.1</b>
32	Lochee Rd (184)	338767	730856	39.7	31.7	27.4	24.9	26.5	22.1	23.2	26.0	33.7	16.7	41.9	36.9	29.2	100.0	1.0	29.2	24.8
	Lochee Rd (Romon 1)			42.8	37.5	37.0	33.4	31.4	27.0	28.4	32.4	41.2	47.6	49.2	50.5	<b>38.2</b>	100.0	1.0	<b>38.2</b>	32.5
	Lochee Rd (Romon 2)			47.0	36.3	36.1	32.6	31.3	27.3	26.9	31.3	40.0	44.5	45.7	46.6	<b>37.1</b>	100.0	1.0	<b>37.1</b>	31.6
	Lochee Rd (Romon 3)			46.5	36.3	32.9	34.8	33.5	26.6	26.5	31.3	39.0	46.3	50.5	48.5	<b>37.7</b>	100.0	1.0	<b>37.7</b>	32.1
158	Lochee Rd (Romon) Average	338861	730773	45.4	36.7	35.3	33.6	32.1	27.0	27.3	31.3	40.1	46.1	48.5	48.5	<b>37.7</b>	100.0	1.0	<b>37.7</b>	32.0
36	Lochee Rd/Polepark Rd	339016	730586	33.6	24.3	20.4	19.6	17.6	11.2	16.2	17.9	19.1	25.3	28.3	29.0	21.9	100.0	1.0	21.9	18.6
37	Logie St (114)	338184	731293	48.4	44.9	35.4	41.9	45.4	37.4	39.7	43.9	55.0	47.3	51.7	53.9	<b>45.4</b>	100.0	1.0	<b>45.4</b>	<b>38.6</b>
38	Logie St (98)	338252	731258	41.3	29.6	26.0	25.9	20.6	20.5	18.1	20.9	26.9	31.4	40.5	37.0	28.2	100.0	1.0	28.2	24.0
39	Loons Rd (1)	338211	731293	47.3	36.4	29.4	32.9	35.9	23.0	33.3	33.3	36.5	35.2	38.5	39.0	35.1	100.0	1.0	35.1	29.8
237	Lower Princess St	340964	730855	30.0	26.5	21	24.2	20.4	M	23.4	23.7	27.1	31.2	25.6	30.0	25.7	91.7	1.0	25.7	21.8
	Meadowside (Romon 1)			38.9	34.3	24.1	31.7	32.0	23.9	28.4	29.8	34.2	36.4	39.2	38.1	32.6	100.0	1.0	32.6	27.7



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	Meadowside (Romon 2)			41.0	34.7	24.4	31.4	34.3	23.5	28.5	28.9	34.7	38.2	38.3	41.4	33.3	100.0	1.0	33.3	28.3
	Meadowside (Romon 3)			40.6	35.7	25.2	32.9	29.8	25.4	27.4	28.4	34.9	39.2	41.5	36.9	33.2	100.0	1.0	33.2	28.2
149	Meadowside (Romon) Average	340243	730653	40.2	34.9	24.6	32.0	32.0	24.3	28.1	28.7	34.6	37.9	39.7	38.8	33.0	100.0	1.0	33.0	28.1
42	Muirton Rd (6)	338156	731294	27.9	30.7	15.0	22.7	27.0	15.2	26.1	25.6	26.4	23.1	19.7	18.4	23.2	100.0	1.0	23.2	19.7
185	Murraygate (46)	340409	730484	23.6	20.1	12.6	14.3	16.8	9.4	12.9	14.8	13.5	18.5	17.6	21.4	16.3	100.0	1.0	16.3	13.8
189	Myrekirk Rd (29)	335420	731726	37.2	25.6	27.5	21.5	20.5	15.9	20.5	21.2	24.0	26.4	34.2	31.6	25.5	100.0	1.0	25.5	21.7
48	Nethergate (132)/Marketgait	340074	729984	28.0	26.7	21.2	24.4	21.7	18.0	21.0	21.9	24.1	27.6	26.3	32.0	24.4	100.0	1.0	24.4	20.7
47	Nethergate (40)	340230	730124	32.6	35.2	21.6	30.0	30.3	22.0	31.8	29.8	31.7	30.2	27.3	30.8	29.4	100.0	1.0	29.4	25.0
45	Nethergate (6)	340274	730171	34.1	36.2	28.0	28.6	27.2	25.8	27.1	27.1	31.3	32.8	33.4	32.7	30.4	100.0	1.0	30.4	25.8
213	Nethergate (64)	340196	730089	30.1	35.2	26.2	29.4	31.2	29.2	35.0	37.6	M	36.3	36.2	39.7	33.3	91.7	1.0	33.3	28.3
44	Nethergate (88)	340163	730061	32.7	33.8	24.1	32.7	39.2	27.2	41.5	M	37.5	34.3	29.9	35.8	33.5	91.7	1.0	33.5	28.5
46	Nethergate (95)	340033	729957	26.4	24.7	22.2	20.7	25.5	17.5	19.9	22.1	24.0	26.7	28.0	30.6	24.0	100.0	1.0	24.0	20.4
239	Princes St (185)	341077	731031	37.9	37.0	25.0	37.6	46.5	26.1	42.7	41.7	41.5	34.0	29.0	35.9	36.2	100.0	1.0	36.2	30.8
49	Rankine St (2)	338768	730900	40.5	29.0	30.7	26.4	25.1	15.9	22.5	22.8	29.3	36.4	46.1	41.2	30.5	100.0	1.0	30.5	25.9
228	Riverside Esplanade/S. Crichton St.	340516	729991	29.7	27.4	20.3	21.6	25.7	19.1	22.5	25.1	25.7	28.5	24.9	32.2	25.2	100.0	1.0	25.2	21.4
224	Seagate (112)	340528	730537	37.7	34.2	35.2	30.5	30.5	25.1	27.5	27.3	32.3	39.3	41.4	M	32.8	91.7	1.0	32.8	27.9
236	Seagate (36-40)	340463	730420	36.0	32.9	29.8	29.3	26.1	21.9	25.2	27.7	28.2	35.4	38.1	38.6	30.8	100.0	1.0	30.8	26.2
54	Seagate (9)	340467	730388	31.0	28.3	20.3	26.2	27.1	19.1	26.7	24.5	25.4	27.7	27.9	31.7	26.3	100.0	1.0	26.3	22.4
190	Seagate (97)	340516	730499	36.4	38.5	29.5	33.7	40.6	27.6	35.6	35.6	38.7	36.4	M	34.9	35.2	91.7	1.0	35.2	29.9
217	Seagate (99)	340535	730522	32.7	36.5	24.5	29.5	35.9	24.7	33.7	34.8	33.4	33.8	35.1	58.7	34.4	100.0	1.0	34.4	29.3
	Seagate (Romon 1)			38.1	36.6	30.3	33.5	30.8	23.5	33.8	32.0	36.2	33.7	37.1	37.1	33.6	100.0	1.0	33.6	28.5
	Seagate (Romon 2)			39.3	35.6	27.6	33.6	35.1	25.5	32.8	32.8	33.6	32.9	32.9	35.6	33.1	100.0	1.0	33.1	28.1
	Seagate (Romon 3)			39.8	34.9	29.3	32.9	35.9	25.2	34.3	32.2	35.5	34.4	31.7	36.8	33.6	100.0	1.0	33.6	28.5
159	Seagate (Romon) Average	340487	730446	39.1	35.7	29.1	33.3	33.9	24.7	33.6	32.5	35.1	33.7	33.9	36.5	33.4	100.0	1.0	33.4	28.4
55	Soapwork Lane	340099	730650	33.0	30.7	25.5	26.7	26.6	19.2	22.8	25.2	27.0	34.9	35.4	34.1	28.4	100.0	1.0	28.4	24.2

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218	South Marketgait (Lampost 18)	340291	729979	30.7	25.6	16.7	25.4	26.4	18.4	26.1	26.4	24.5	24.5	26.5	31.7	25.2	100.0	1.0	25.2	21.5
235	South Marketgait/Nethergate	340106	729972	25.3	21.5	15.7	20.3	21.6	12.8	19.3	20.6	20.1	22.0	26.1	26.7	21.0	100.0	1.0	21.0	17.9
151	South Road (1 Denbank)	335188	731528	37.3	26.9	24.7	22.7	22.6	19.2	24.3	25.2	30.7	28.7	34.3	32.1	27.4	100.0	1.0	27.4	23.3
162	St Andrews St/Seagate(116)	340532	730548	33.4	32.5	26.6	27.5	30.4	22.0	25.2	26.2	29.9	31.5	31.4	33.5	29.2	100.0	1.0	29.2	24.8
59	Strathmore Ave (353)	339609	731871	36.4	29.9	21.5	26.1	29.8	19.8	32.5	33.5	32.2	31.4	34.1	35.7	30.2	100.0	1.0	30.2	25.7
219	Thomson Avenue (Street Sign)	340542	730194	31.5	26.2	21.6	25.0	27.0	19.9	22.1	24.3	25.5	26.9	30.6	33.6	26.2	100.0	1.0	26.2	22.3
229	Thomson Avenue/S.Crichton St	340421	730078	30.2	24.8	18.4	22.9	21.8	17.7	21.8	24.1	26.0	31.2	29.9	31.0	25.0	100.0	1.0	25.0	21.2
60	Trades Lane (31)	340575	730500	28.7	21.9	17.8	18.3	21.6	13.4	17.4	18.2	18.9	23.1	24.3	24.3	20.7	100.0	1.0	20.7	17.6
93	Victoria Rd (10)	340230	730673	37.6	29.1	29.8	26.9	27.2	19.4	25.1	23.4	27.3	30.3	36.0	39.4	29.3	100.0	1.0	29.3	24.9
184	Victoria Rd (104)/William St	340697	730950	29.9	26.1	16.8	24.7	28.0	18.5	23.4	24.5	26.1	27.6	25.7	29.8	25.1	100.0	1.0	25.1	21.3
191	Victoria Rd (4 India Buildings)	340213	730633	35.2	30.3	21.2	25.0	26.1	15.8	20.8	25.0	25.3	30.7	33.2	34.5	26.9	100.0	1.0	26.9	22.9
68	Victoria Rd (60)	340375	730779	37.7	29.0	24.9	32.4	33.0	21.7	27.1	26.7	32.6	34.4	35.8	36.6	31.0	100.0	1.0	31.0	26.3
70	Victoria Rd/Hilltown	340274	730714	51.6	41.0	46.1	37.9	37.0	39.7	36.7	36.7	48.9	58.9	76.8	61.4	47.7	100.0	1.0	47.7	40.6
243	Victoria St (Eagle Mill)	340836	731026	26.8	18.0	16.4	17.1	16.4	10.1	11.6	13.8	16.7	21.5	23.7	24.5	18.1	100.0	1.0	18.1	15.3
71	Victoria St / Albert St	341071	731072	33.3	25.7	19.1	25.6	23.2	15.3	19.7	21.4	23.2	25.5	28.0	30.8	24.2	100.0	1.0	24.2	20.6
205	West Marketgait/ Old Mill (23)	339773	730436	46.2	40.3	43.6	33.4	35.5	30.5	30.3	35.3	49.3	58.3	60.9	51.8	43.0	100.0	1.0	43.0	36.5
231	West Marketgait/ Ward Road	339834	730314	32.4	28.4	23.4	24.3	22.7	17.4	23.3	24.4	27.8	33.9	34.2	38.9	27.6	100.0	1.0	27.6	23.5
183	West Marketgait/Guthrie St	339805	730338	43.4	34.5	39.7	31.3	30.6	27.9	30.7	33.8	42.1	48.2	53.2	46.8	38.5	100.0	1.0	38.5	32.7
72	Westport (2)	339842	730122	25.1	21.7	18.1	16.1	17.5	13.4	16.7	17.8	21.2	25.8	28.6	26.2	20.7	100.0	1.0	20.7	17.6
73	Whitehall Cr (4)	340376	730109	32.2	29.6	24.3	27.1	26.3	22.4	23.6	26.2	28.3	29.0	29.9	31.2	27.5	100.0	1.0	27.5	23.4
161	Whitehall Cr/Union St (50)	340305	730051	24.9	21.5	14.4	17.6	18.0	13.4	18.3	19.1	19.3	21.6	22.2	25.6	19.7	100.0	1.0	19.7	16.7
76	Whitehall St (1)	340265	730153	39.7	43.8	36.4	36.7	37.7	31.2	38.8	37.7	42.5	41.1	41.6	M	38.8	91.7	1.0	38.8	33.0
81	Whitehall St (12)	340293	730142	39.3	40.9	25.5	36.8	36.2	26.0	34.0	35.4	33.2	31.7	30.1	38.8	34.0	100.0	1.0	34.0	28.9
77	Whitehall St (15)	340322	730098	36.8	29.2	23.2	25.1	27.8	19.4	23.5	25.7	27.4	30.1	29.6	35.0	27.7	100.0	1.0	27.7	23.6
74	Whitehall St (40)	340330	730106	36.6	36.2	25.5	36.6	38.5	25.4	31.2	29.9	29.5	31.4	32.4	38.6	32.7	100.0	1.0	32.7	27.8

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75	Whitehall St (5)	340289	730128	39.6	36.2	32.4	31.0	28.0	25.6	26.1	29.8	32.6	33.9	35.8	37.5	32.4	100.0	1.0	32.4	27.5
	Whitehall St (Romon 1)			36.5	36.5	26.3	33.1	36.1	24.7	33.1	30.7	31.2	32.1	32.3	34.3	32.2	100.0	1.0	32.2	27.4
	Whitehall St (Romon 2)			36.5	35.9	26.3	31.8	34.3	24.8	31.6	32.4	31.4	30.5	32.4	36.7	32.1	100.0	1.0	32.1	27.2
	Whitehall St (Romon 3)			36.4	36.6	23.9	30.9	35.2	25.2	33.8	31.4	31.8	30.2	30.4	36.7	31.9	100.0	1.0	31.9	27.1
160	Whitehall St (Romon) Average	340278	730156	36.5	36.3	25.5	31.9	35.2	24.9	32.8	31.9	31.5	30.9	31.7	35.9	32.1	100.0	1.0	32.1	27.2
82	Woodside Ave	340776	732307	16.3	13.7	8.7	8.4	7.3	4.1	6.6	7.3	8.9	12.4	11.6	15.4	10.1	100.0	1.0	10.1	8.5

**Notes**

- (1) Exceedences of the NO<sub>2</sub> annual mean objective are shown in **bold**. (Borderline values are coloured orange).
- (2) NO<sub>2</sub> annual means greater than 60µg/m<sup>3</sup> are shown in **bold & underlined**, indicating a potential exceedence of the NO<sub>2</sub> 1-hr mean objective
- (3) Sites shaded green were monitoring locations installed in 2020.
- (4) M' means that the diffusion tube was either missing or else interference meant that the results were considered invalid.
- (5) See Appendix C for details on bias adjustment.

## Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

### New or Changed Sources Identified Within Dundee City Council During 2021

Dundee City Council has not identified any new sources relating to air quality within the reporting year of 2021.

### Additional Air Quality Works Undertaken by Dundee City Council During 2021

#### Dundee Low Emission Zone scheme development

The Council continued to work with SEPA, Transport Scotland and the Scottish Government in developing a suitable LEZ scheme for Dundee. The National Modelling Framework created within CAFS has provided required evidence on the predicted impacts of the proposed LEZ scheme on pollutant concentrations within the proposed LEZ area and Dundee AQMA. Work undertaken in 2021 on the Dundee LEZ scheme is outlined in section 2.2.3 of Chapter 2 of this report.

Full details of the final Dundee LEZ scheme is available on the LEZ pages of the DCC website – [www.dundee.gov.uk/lez](http://www.dundee.gov.uk/lez), with a map of the LEZ area shown in Figure 2.7 within Chapter 2 of this report. The website also contains the following reports and other documents produced during the LEZ development process.

[SEPA Dundee Emissions Analysis Report \(1.42MB PDF\)](#)

[SEPA Low Emissions Zone Dundee Evidence Report September 2021 \(4.2MB PDF\)](#)

#### QA/QC of Diffusion Tube Monitoring

Monitoring of NO<sub>2</sub> concentrations using passive diffusion tubes (PDT) is widely used throughout the UK. Provided that care is taken with the storage, handling and analysis of the tubes, and an appropriate “bias-adjustment” factor is applied, the overall uncertainty of the annual mean is expected to be about +/-20%. The key issues to be considered are the performance of the laboratory, the precision of the diffusion tubes, and the application of a suitable bias adjustment factor. These issues are considered in turn below.

#### Laboratory Performance

The diffusion tubes used by Dundee City Council are supplied by Gradko and analysed by Tayside Scientific Services utilising the 20% Triethanolamine (TEA) in water preparation method. Diffusion tubes are exposed for 4 to 5 weeks in accordance with the recommended dates supplied by Defra. The method for preparing and analysing tubes has remained unchanged since 2001. Two

diffusion tubes from each monthly batch are used as blanks. These tubes are not exposed but are taken round during the monthly deployment and collection and stored in the refrigerator during the exposure period. They are analysed along with the appropriate batch of exposed tubes. The purpose of the blanks is to determine whether contamination occurred during the preparation or deployment.

Defra and the Devolved Administrations advise that diffusion tubes used for Local Air Quality Management should be obtained from laboratories that have demonstrated satisfactory performance in the AIR Proficiency Testing (PT) scheme. Laboratory performance in AIR PT is also assessed, by the National Physical Laboratory (NPL), alongside laboratory data from the monthly NPL Field Intercomparison Exercise carried out at Marylebone Road, central London.

AIR is an independent analytical proficiency-testing (PT) scheme, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL). AIR PT started in April 2014 and combines two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme. AIR NO<sub>2</sub> PT forms an integral part of the UK NO<sub>2</sub> Network's QA/QC, and is a useful tool in assessing the analytical performance of those laboratories supplying diffusion tubes to Local Authorities for use in the context of Local Air Quality Management (LAQM). With consent from the participating laboratories, LGC Standards provides summary proficiency testing data to the LAQM Helpdesk for hosting on the webpages at <http://laqm.defra.gov.uk/diffusion-tubes/qa-qc-framework.html> . This information is updated on a quarterly basis following completion of each AIR PT round.

Tayside Scientific Services demonstrated satisfactory performance in the latest report for 2021.

All diffusion tube changeovers during 2021 were in accordance with the diffusion tube calendar.

### **Diffusion Tube Annualisation**

All diffusion tube monitoring locations within Dundee City Council recorded data capture of more than 75% therefore it was not required to annualise any monitoring data.

### **Diffusion Tube Bias Adjustment Factors**

Dundee City Council have applied a local bias adjustment factor of 0.85 to the 2021 monitoring data. A summary of bias adjustment factors used by Dundee City Council over the past five years is presented in Table C.1.

**Table C.1 Bias Adjustment Factor**

Year	Local or National	If National, Version of National Spreadsheet	PTD Bias Adjustment Factor
2021	Local	-	0.85
2020	Local	-	0.85
2019	Local	-	0.85
2018	Local	-	0.84
2017	Local	-	0.81

**Suitable Bias Adjustment Factor**

The discussion and calculation of a suitable bias adjustment factor is detailed below:

The diffusion tubes are supplied by Gradko and analysed by Tayside Scientific Services utilising the 20% Triethanolamine (TEA) in water preparation method. The bias adjustment factor available on the LAQM Support Website for Tayside Scientific Services is 0.77<sup>2</sup> (Spreadsheet Version Number: 09/22). This is based the kerbside National inter-comparison site at Marylebone Road (0.77).

**Factor from Local Co-location Studies**

Dundee City Council co-locates three nitrogen dioxide diffusion tubes with each of the roadside automatic nitrogen dioxide analysers. Co-location studies were carried out at 4 automatic monitoring locations in 2021. The factor for each study is shown in Table C.2a along with the factor for the national inter-comparison site at Marylebone Road in London. A minimum of 9 months is required to make a valid bias calculation. All 4 of the Dundee City Council co-location studies met the criteria in 2021. The QA/QC procedures for all the Dundee City Council automatic analysers used in the bias-calculation is equivalent to the Automatic Urban and Rural Network (AURN), which is run by the national government. Tayside Scientific Services have demonstrated satisfactory performance for the analysis of diffusion tubes over quarterly AIR-PT/WASP rounds in 2021. The automatic analyser period means are calculated from mid-day on tube changeover days.

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<sup>2</sup> [https://laqm.defra.gov.uk/wp-content/uploads/2022/06/Database\\_Diffusion\\_Tube\\_Bias\\_Factors\\_v06\\_22-FINAL.xlsx](https://laqm.defra.gov.uk/wp-content/uploads/2022/06/Database_Diffusion_Tube_Bias_Factors_v06_22-FINAL.xlsx)

**Table C.2a Bias Factors from 2021 Co-location Studies and National Bias Adjustment Spreadsheet (Version 09/22\_final)**

Site Name	Site Type <sup>1</sup>	Length of Study (months)	PDT <sup>2</sup> Mean Conc. (Dm) (µg/m <sup>3</sup> )	Analyser Mean Conc. (Cm) (µg/m <sup>3</sup> )	% DC <sup>3</sup>	Bias (B)	Tube Precision & average CV <sup>4</sup>	Bias Adjustment Factor (A) (Cm/Dm)	Adjusted Tube Mean (µg/m <sup>3</sup> )
Lochee Road	R	12	38	32	100	20% (14% - 25%)	G (4%)	<b>0.84</b> (0.8 – 0.87)	32 (30 – 33)
Meadowside	R	10	32	27	97	20% (9% - 30%)	G (4%)	<b>0.84</b> (0.77 - 0.92)	27 (25 - 30)
Seagate	R	12	33	30	100	11% (5% - 16%)	G (4%)	<b>0.9</b> (0.86 - 0.95)	30 (29 - 32)
Whitehall Street	R	12	32	27	100	17% (13% - 21%)	G (3%)	<b>0.86</b> (0.83 - 0.89)	28 (27 - 29)
Marylebone Road Intercomparison	K	11	55	42	n/a	30.2%	G	<b>0.77</b>	

1 - R= Roadside, K= Kerbside

2 - PDT = Passive Diffusion Tube for NO<sub>2</sub>

3 - %DC = Percentage Data Capture on the automatic analyser for the periods used

4 - Tube precision is determined as follows: **G** = Good precision - coefficient of variation (CV) of diffusion tube replicates is considered G when the CV of eight or more periods is less than 20%, and the average CV of all monitoring periods is less than 10%; **P** = Poor precision - CV of four or more periods >20% and/or average CV >10%; **S** = Single tube, therefore not applicable; **na** = not available.

### Discussion of choice of factor to use

The majority of nitrogen dioxide diffusion tubes operated by Dundee City Council are located at roadside or kerbside locations. In view of this it is normally considered appropriate to use an overall factor derived from roadside and kerbside sites. A manual approximate orthogonal regression calculation using Bias B figures (obtained from the precision and accuracy spreadsheets<sup>3</sup>) was carried out for the local roadside sites separately and incorporating the national inter-comparison kerbside site at Marylebone Road. The calculation was carried out in accordance with the guidance available on the Defra website prepared by Air Quality Consultants<sup>4</sup> (AQC) (see Table C.2b). The factor obtained using only local roadside sites was 0.85, and 0.84 when the kerbside site at Marylebone Road was included. The 0.85 bias correction factor represents a more conservative approach and has been used to bias correct the diffusion tube data presented in this report.

<sup>3</sup> <http://laqm.defra.gov.uk/bias-adjustment-factors/local-bias.html>

<sup>4</sup> <http://laqm.defra.gov.uk/documents/NO2-Diffusion-Tube-Collocation-Methodology.pdf>

**Table C.2b Manual Approximate Orthogonal Regression Calculation 2021**

Co-location Sites 2021	Site Type <sup>1</sup>	Bias Factor A	Bias B
Lochee Road	R	0.84	20%
Meadowside	R	0.84	20%
Seagate	R	0.90	11%
Whitehall St	R	0.86	17%
<b>Mean Local</b>		0.86	17.0%

Manual orthogonal regression Calculation as para 2.4 AQC doc <sup>2</sup>		
Express as a factor	Add 1	Inverse
0.17	1.17	<b>0.85</b>

<b>National:</b> Marylebone Road Intercomparison	K	0.77	30.2%
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<b>Combined Local &amp; National:</b> Mean Combined		0.84	19.6%
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0.196	1.196	<b>0.84</b>
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**Notes:**

1 - R= Roadside, K= Kerbside

2 - Paragraph 2.4 of AQC's report states, "For most purposes, a reasonable approximation of our method can be derived by averaging the bias values, expressed as a factor, i.e. -16% is -0.16. Next add 1 to this value, e.g. -0.16 + 1.00 equals 0.84 in this example, then take the inverse to give the bias adjustment factor 1/0.84 = 1.19. (This will not be exactly the same as the correction factor calculated using orthogonal regression, but will be reasonably close). IT IS IMPORTANT NOT TO AVERAGE THE ADJUSTMENT FACTORS."

**NO<sub>2</sub> Fall-off with Distance from the Road**

Fall-off-with-distance calculations were required for four non-automatic monitoring sites, where the annual mean concentrations were greater than 36µg/m<sup>3</sup> and the monitoring site is not located at a point of relevant exposure. Details of the sites, and the methodology used are included in Table 3.1 in Section 3.1.4. The measurements used in the calculation are contained in Table A.2.

**Table C.3 NO<sub>2</sub> Fall off With Distance Calculations (concentrations presented in µg/m<sup>3</sup>)**

Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted)	Background Concentration	Concentration Predicted at Receptor	Comments
DT 70	1.15	3.16	<b>40.6</b>	13.8	35.0	
DT 37	1.73	2.26	<b>38.6</b>	12.3	<b>37.0</b>	<i>Predicted concentration at Receptor within 10% the AQS objective.</i>
DT 205	2.80	2.85	<b>36.5</b>	12.3	<b>36.4</b>	<i>Predicted concentration at Receptor within 10% the AQS objective.</i>
DT 31	2.22	2.47	<b>36.1</b>	12.3	35.5	



## QA/QC of Automatic Monitoring

All automatic analysers (excluding Osiris units) are audited twice yearly by an external consultant, Ricardo. The gas analysers do not have on-site gases and are manually calibrated every 3 weeks by Ricardo using National Physical Laboratory (NPL) traceable gas.

Dundee City Council secured funding from the Scottish Executive to commission Ricardo to assist with data management and ratification procedures. Dundee joined the 'Calibration Club' run by Ricardo at the end of 2006. Ricardo have ratified all the real-time monitoring data reported on the Scottish Air Quality Website from 2006 onwards under contract from the Scottish Government.

<http://www.scottishairquality.scot/latest/summary?view=la>

All instruments (excluding Osiris units) are serviced and calibrated every 6 months by the equipment supplier. Osiris units undergo quarterly flow checks and filter changes as well as annual service and calibration by the manufacturer (Turnkey Instruments).

The Partisol is a semi-automatic reference equivalent PM<sub>10</sub> analyser. It contains 16 'Emfab' filters, each is exposed for 24 hours allowing for 2 weeks continuous operation (usually with two blanks). The filters are supplied by the equipment manufacturer and conditioned and weighed before and after the sampling period by Tayside Scientific Services using in-house procedures.

The Fidas 200 is a nephelometer, which is calibrated using a HEPA filter and 'CalDust' by Ricardo (Local Site Operator) every 3 weeks for the first 6 months following installation, thereafter it is calibrated during the twice-yearly service and audits

## PM<sub>10</sub> and PM<sub>2.5</sub> Monitoring Adjustment

Dundee utilise several methods for monitoring particulate matter (PM<sub>10</sub>) within the city. TEOM and Osiris monitors have heated inlets. These tend to drive off volatile organic particulate matter and in consequence the measured concentrations tend be lower than those measured by gravimetric reference standard monitors. The Partisol is a reference equivalent method and had been used historically to determine a local correction factor for the TEOMs, which were designated as non-equivalent in 2006. TEOM PM<sub>10</sub> data presented in this report have been corrected using the Volatile Correction Methodology (VCM) since 2008.

DCC have five Osiris analysers which have been in their current locations since at least 2012. These are also non-equivalent but their measurements are considered indicative of particulate concentrations. Dundee commenced a yearly study in 2005 to compare the PM<sub>10</sub> data measured using an Osiris analyser with that from a TEOM. This study determined that the Osiris generally exaggerates peak values compared to the TEOM. Annually, post service, all 5 Osiris monitors are co-located in-house and their data is compared with that of the designated "master" to derive, if necessary, individual adjustment factors. The factors used to adjust the **2021** data can be made available on request. The "master" Osiris unit has been co-located with the Partisol at the urban

industrial site at Broughty Ferry Road since September 2012, thus allowing the Osiris results presented in this report to be gravimetrically corrected prior to reporting. The gravimetric factor applied to 2021 data was 1.427. This methodology although reasonable for annual mean data, has a tendency to over-estimate the number of daily mean exceedances. Consequently, these results should be treated with some caution.

For comparison with the NAQS objectives annual mean concentrations are calculated from an hourly time base. PM<sub>10</sub> data from the Fidas does not require to be adjusted, determined by the UK Equivalence Testing Programme<sup>5</sup>. The ratified PM<sub>2.5</sub> data has been adjusted for slope by the following factor (1/1.06).

### Automatic Monitoring Annualisation

Annualisation was required for data from four automatic monitors in 2021, a summary of these calculations is presented in Table C.3a to C.3d. NB: annualisation is required for any site with data capture less than 75% but greater than 25%.

### NO<sub>2</sub> Fall-off with Distance from the Road

No automatic NO<sub>2</sub> monitoring locations within Dundee City Council were above 36µg/m<sup>3</sup> during 2021, therefore no distance correction was required.

**Table C.3a Period Adjustment Calculation for CM3, Broughty Ferry Road NO<sub>2</sub> Annual Mean 2021**

Urban Background Locations	Data Capture %	Annual Mean, A <sub>m</sub> (µg/m <sup>3</sup> )	Period Mean, P <sub>m</sub> (µg/m <sup>3</sup> )	Ratio, A <sub>m</sub> /P <sub>m</sub>	Average Ratio, R <sub>a</sub>
CM12, Dundee, Mains Loan	98.52	8.39	8.45	1.117	<b>1.015</b>
Edinburgh, Currie	92.73	5.12	5.02	1.019	
Glasgow Townhead	99.01	18.02	18.27	0.986	
Grangemouth Moray	88.61	13.76	12.61	1.091	
N Lanarkshire Coatbridge Whifflet	96.62	11.45	11.62	0.986	
Site to be annualised					
<b>CM3, Broughty Ferry Rd - NO<sub>2</sub></b>	52.49	<b>12.9</b>	12.66		

<sup>5</sup> <http://laqm.defra.gov.uk/laqm-faqs/faq104.html>

**Table C.3b Period Adjustment Calculation for CM16, Broughty Ferry Road PM<sub>10</sub> Annual Mean 2021 (OSIRIS)**

Urban Background Locations	Data Capture %	Annual Mean, A <sub>m</sub> (µg/m <sup>3</sup> )	Period Mean, P <sub>m</sub> (µg/m <sup>3</sup> )	Ratio, A <sub>m</sub> /P <sub>m</sub>	Average Ratio, R <sub>a</sub>
CM12, Mains Loan	98.52	8.39	8.06	1.041	<b>0.962</b>
Edinburgh Currie	99.60	7.31	7.64	0.956	
Edinburgh St Leonards	99.27	8.46	8.99	0.941	
Glasgow Townhead	99.47	9.17	9.76	0.940	
N Lanarkshire Coatbridge Whifflet	99.92	8.55	9.14	0.936	
Perth Muirton	98.06	8.00	8.36	0.957	
Site to be annualised					
<b>CM16, Broughty Ferry Road - PM<sub>10</sub></b>	63.61	<b>9.9</b>	10.30		

**Table C.3c Period Adjustment Calculation for CM18, Stannergate PM<sub>10</sub> Annual Mean 2021**

Urban Background Locations	Data Capture %	Annual Mean, A <sub>m</sub> (µg/m <sup>3</sup> )	Period Mean, P <sub>m</sub> (µg/m <sup>3</sup> )	Ratio, A <sub>m</sub> /P <sub>m</sub>	Average Ratio, R <sub>a</sub>
CM12, Mains Loan	98.52	8.39	8.15	1.029	<b>0.980</b>
Edinburgh Currie	99.60	7.31	7.37	0.992	
Edinburgh St Leonards	99.27	8.46	8.86	0.955	
Glasgow Townhead	99.47	9.17	9.54	0.961	
N Lanarkshire Coatbridge Whifflet	99.92	8.55	8.98	0.952	
Perth Muirton	98.06	8.00	8.06	0.993	
Site to be annualised					
<b>CM18, Stannergate - PM<sub>10</sub></b>	64.28	<b>16.4</b>	16.69		

**Table C.3d Period Adjustment Calculation for CM13, Broughty Ferry Road PM<sub>10</sub> Annual Mean 2021 (Partisol)**

Urban Background Locations	Data Capture %	Annual Mean, A <sub>m</sub> (µg/m <sup>3</sup> )	Period Mean, P <sub>m</sub> (µg/m <sup>3</sup> )	Ratio, A <sub>m</sub> /P <sub>m</sub>	Average Ratio, R <sub>a</sub>
CM12, Mains Loan	99.45	8.39	7.84	1.069	<b>1.025</b>
Edinburgh Currie	100.00	7.30	7.61	0.960	
Edinburgh St Leonards	100.00	8.46	8.30	1.020	
Glasgow Townhead	100.00	9.17	8.76	1.046	
N Lanarkshire Coatbridge Whifflet	100.00	8.55	8.16	1.048	
Perth Muirton	98.36	8.01	7.97	1.005	
Site to be annualised					
<b>CM13, Broughty Ferry Road - PM<sub>10</sub></b>	64.66	<b>10.2</b>	9.94		

# Appendix D Overview of NO<sub>2</sub> Annual Mean Concentrations across the City

**Notes:**

- 1) Graphs show the NO<sub>2</sub> annual mean concentrations measured at the passive diffusion tube locations and continuous monitoring stations that are highlighted in the accompanying map.
- 2) 'Hollow' markers for the graphs denote for that year there was <85% data capture at continuous monitor (CM) locations, or <75% data capture for passive diffusion tube (DT) locations

## Union Street & Whitehall Street

**Figure D.1 NO<sub>2</sub> Monitoring Locations in Union Street and Whitehall Street**

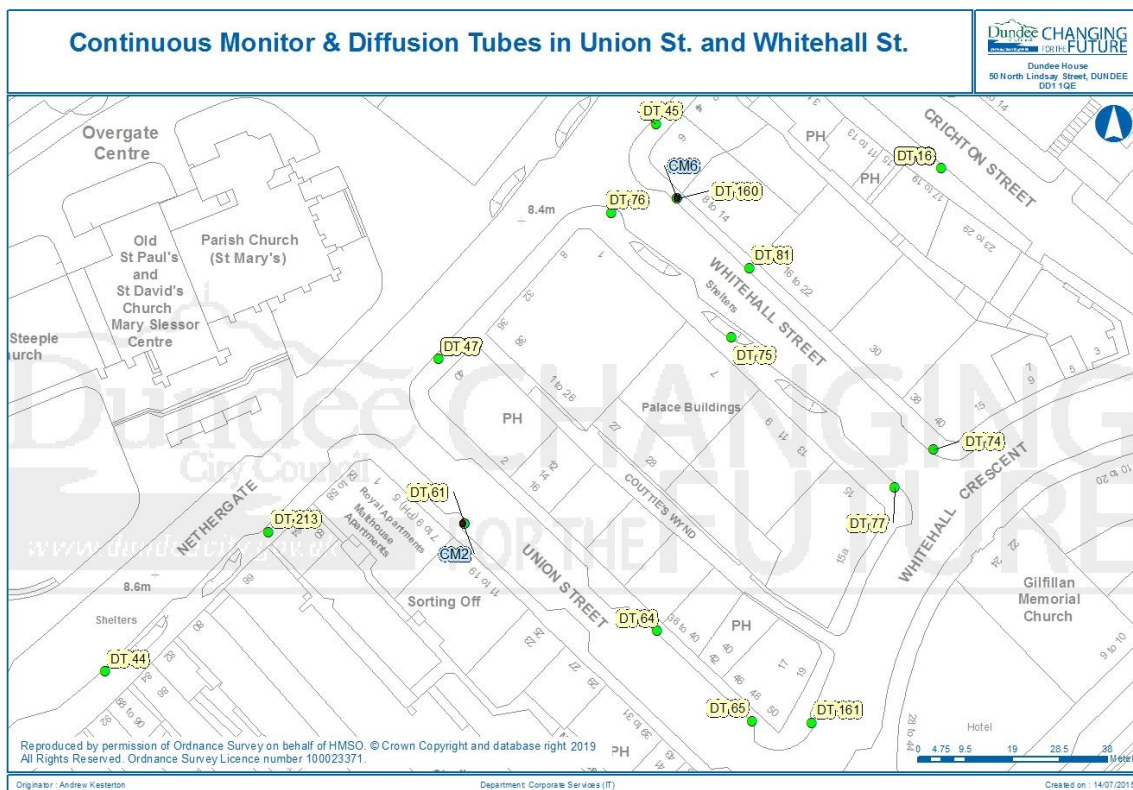


Figure D.2 Overview of NO<sub>2</sub> Concentrations in Union St and Nethergate (east of Marketgait)

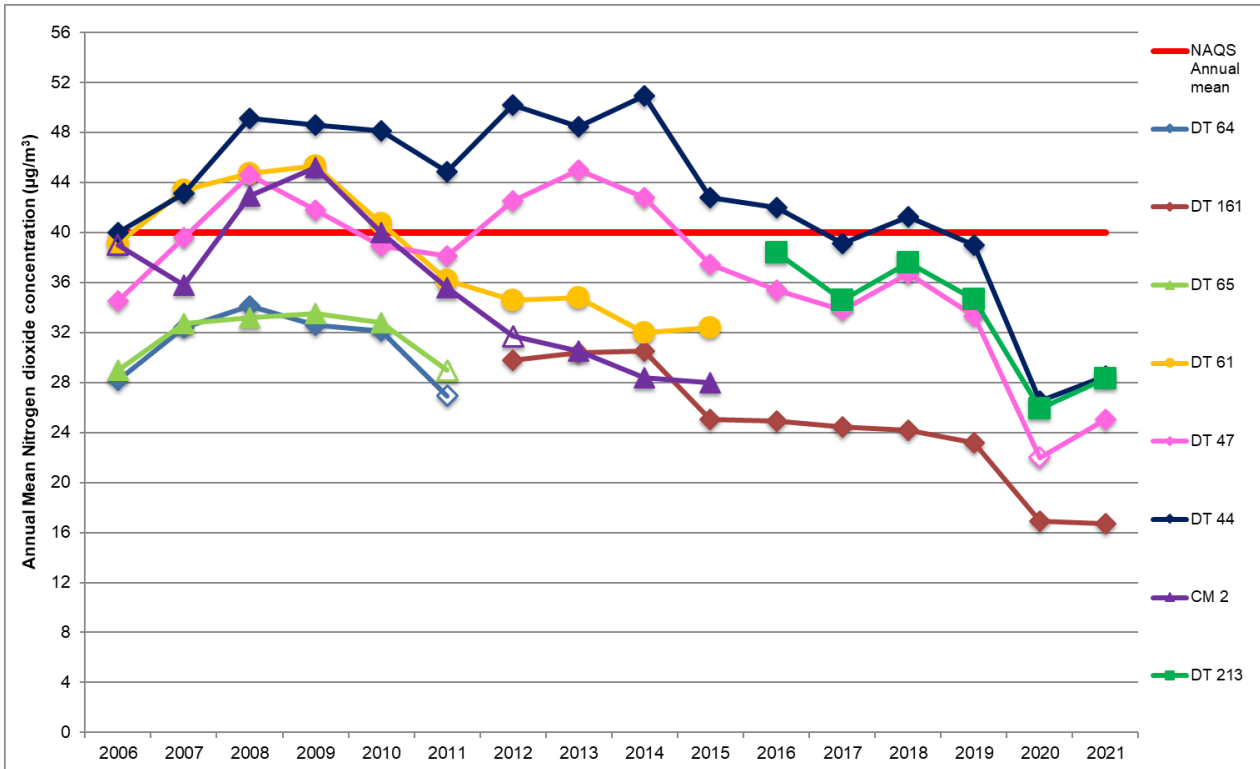
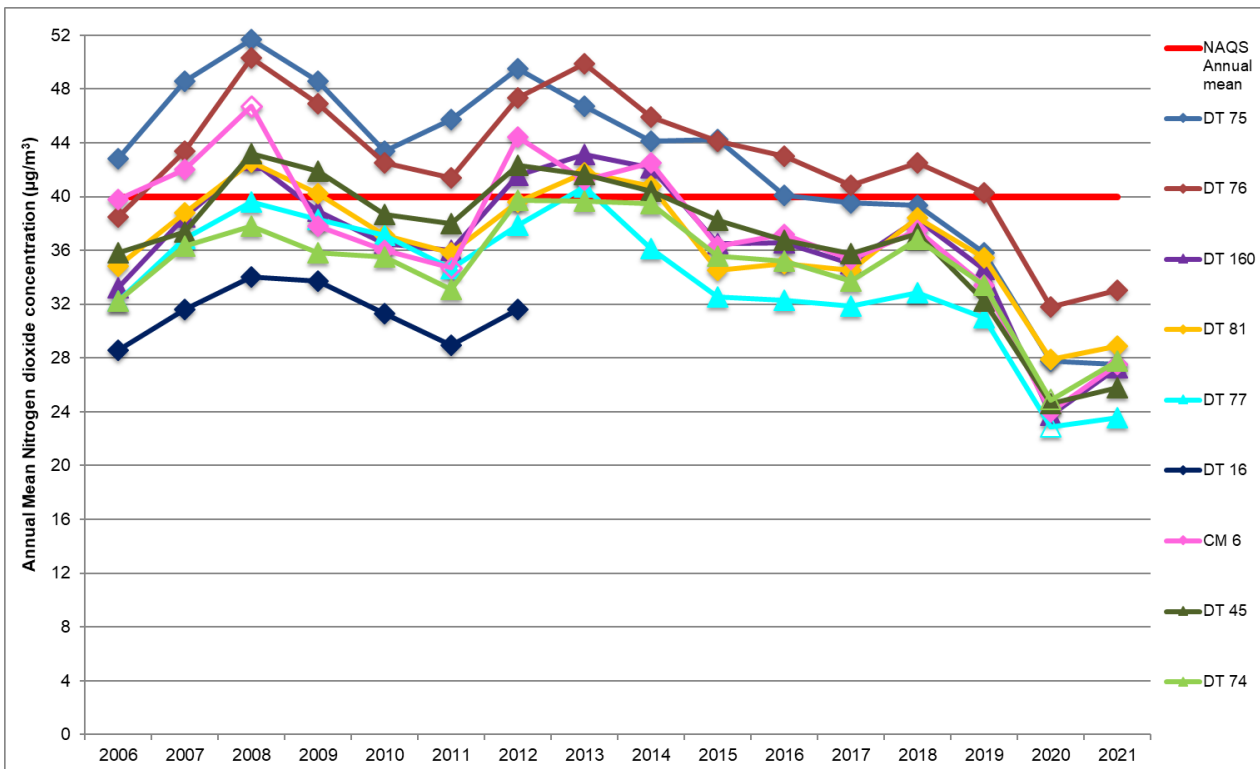


Figure D.3 Overview of NO<sub>2</sub> Concentrations in Whitehall St and Crichton St.



Seagate

Figure D.4 NO<sub>2</sub> Monitoring Locations in Seagate

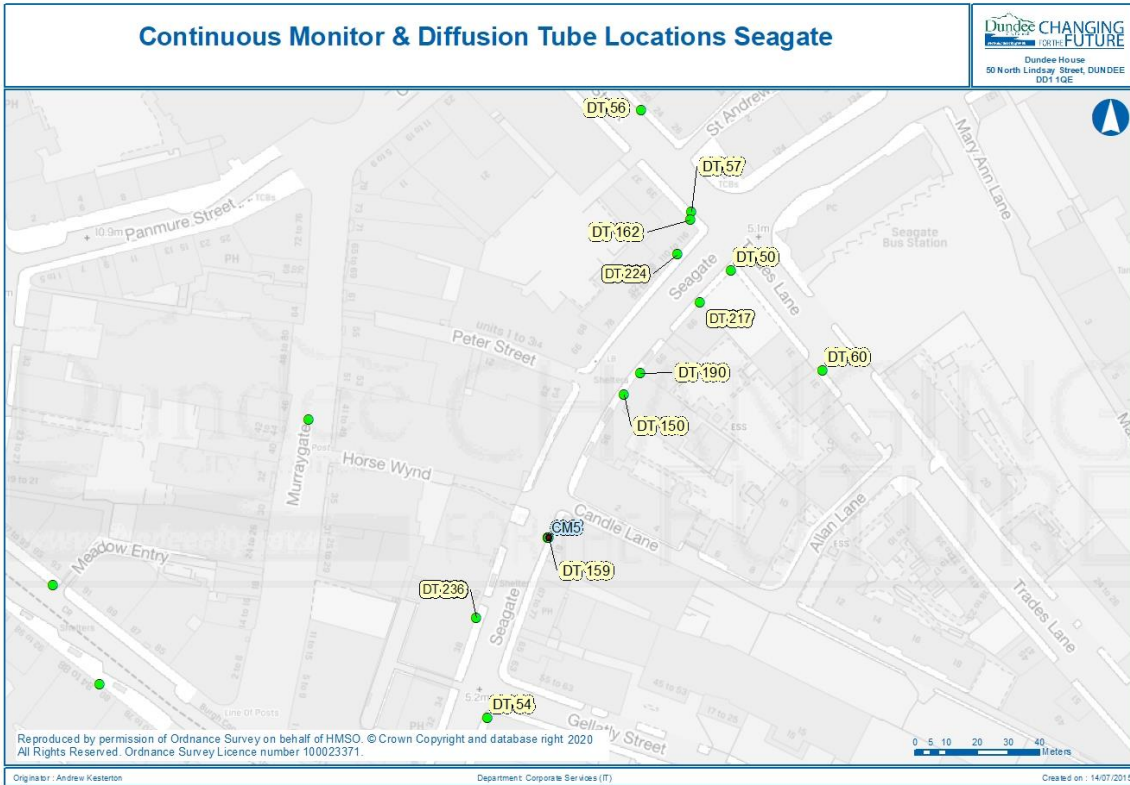
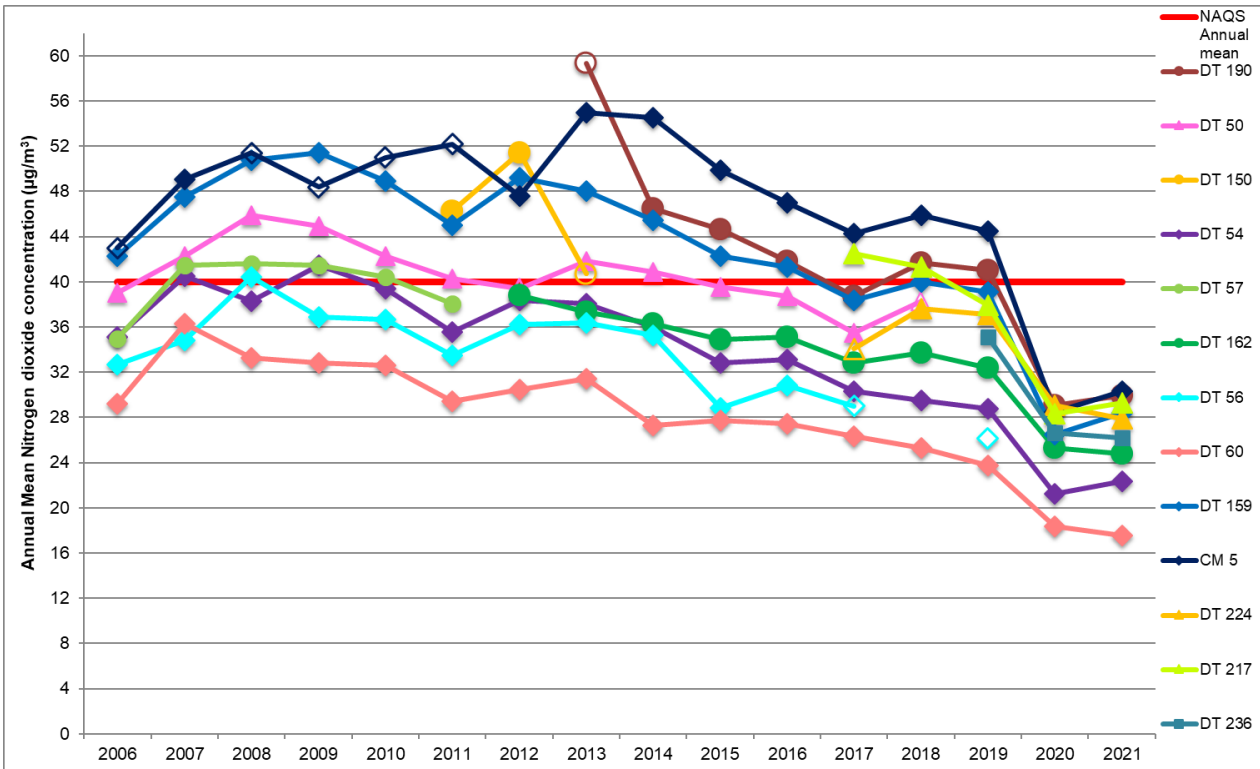


Figure D.5 Overview of NO<sub>2</sub> Concentrations in Seagate.



Nethergate

Figure D.6 NO<sub>2</sub> Diffusion Tube Locations in Nethergate

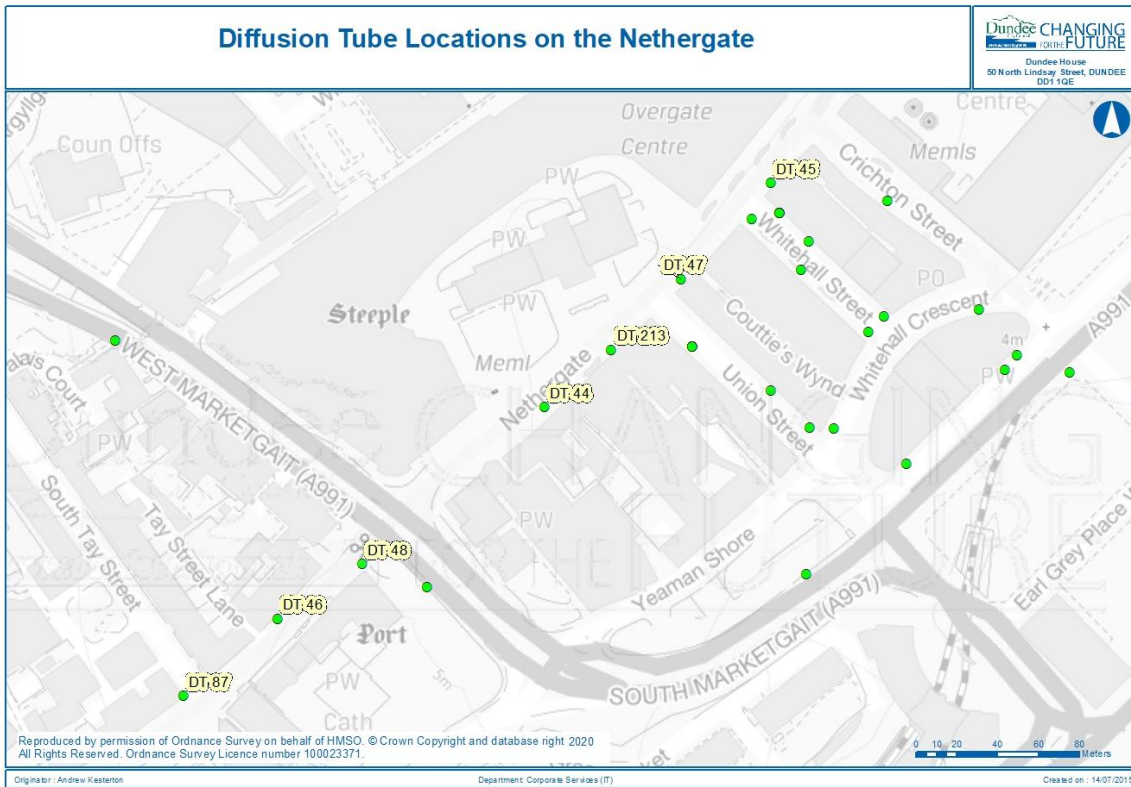
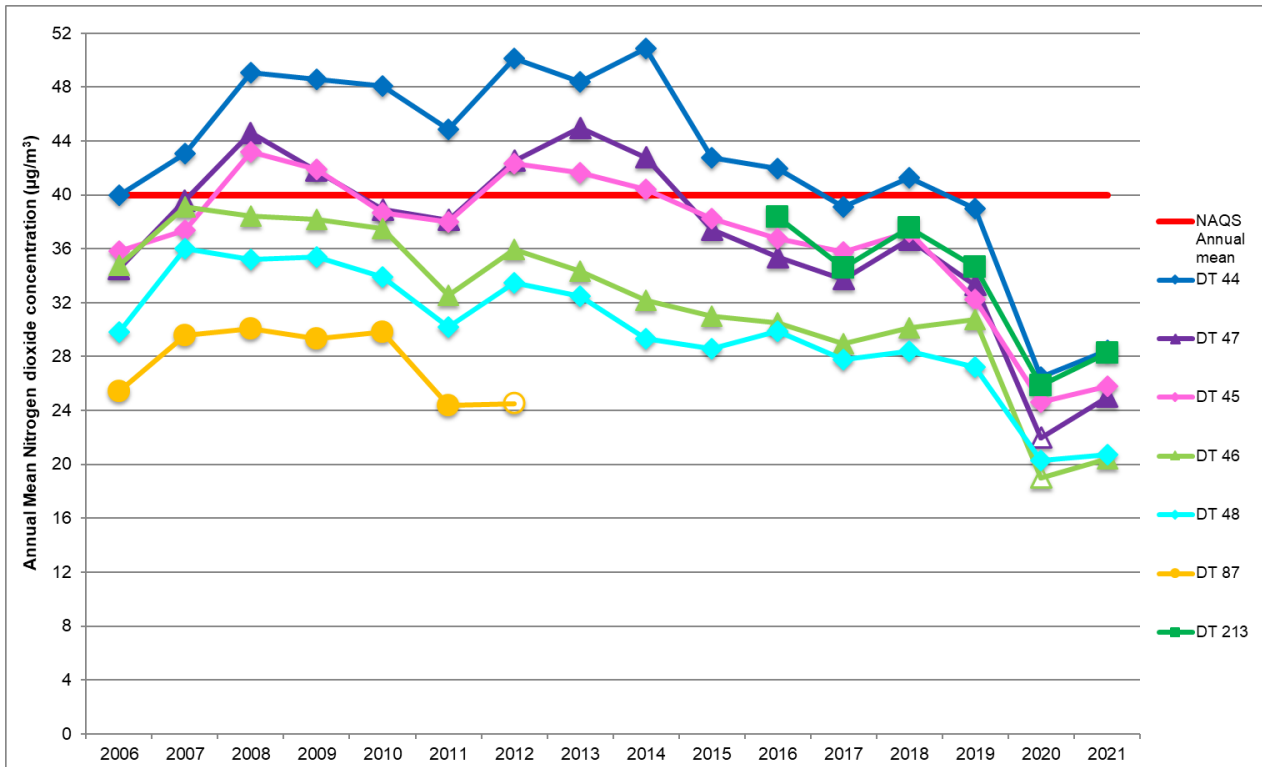


Figure D.7 Overview of NO<sub>2</sub> Diffusion Tube Concentrations in Nethergate.



Victoria Road / Meadowside

Figure D.8 NO<sub>2</sub> Diffusion Tube Locations in Victoria Road / Meadowside

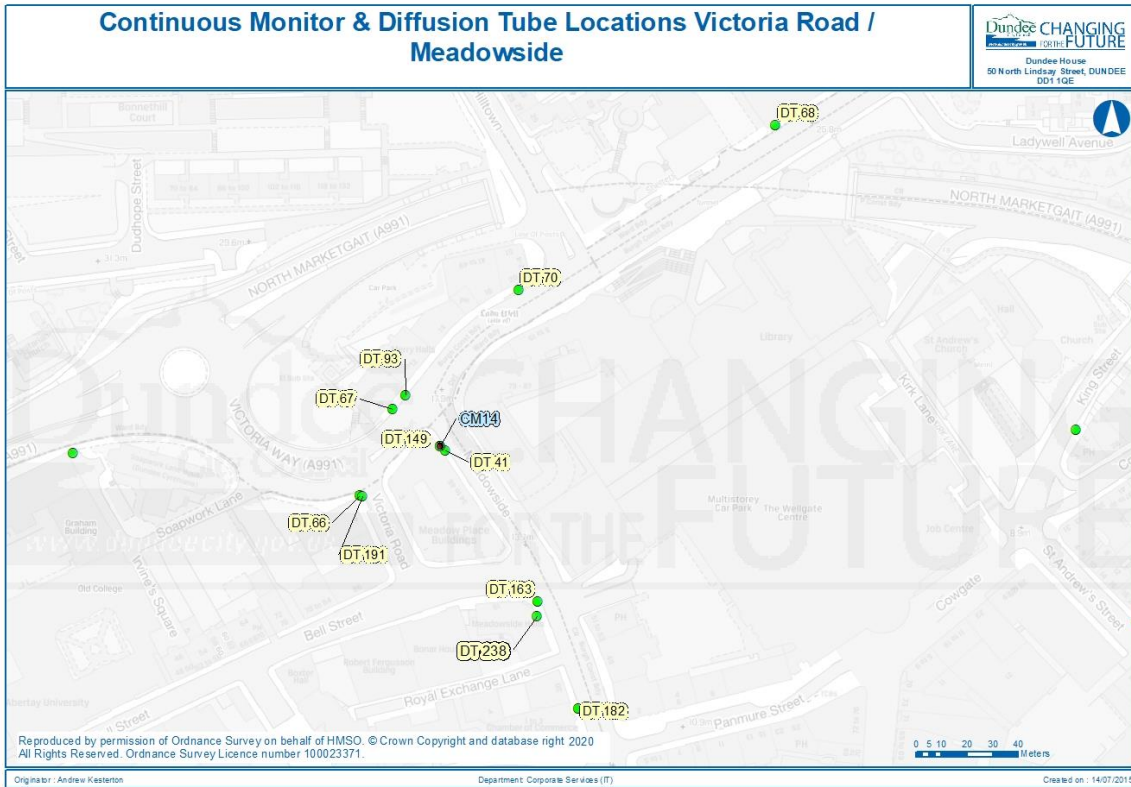
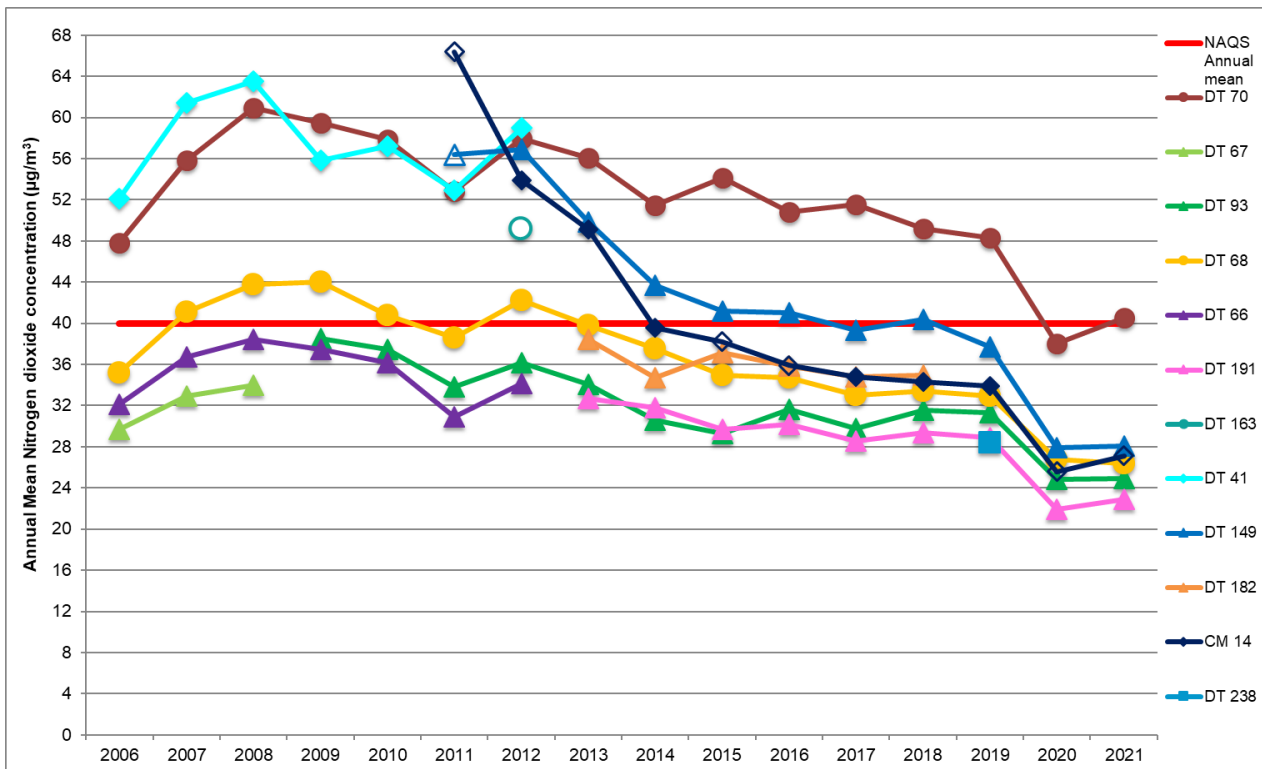


Figure D.9 Overview of NO<sub>2</sub> Concentrations in Victoria Rd / Meadowside





Albert Street / Dura Street

Figure D.10 NO<sub>2</sub> Diffusion Tube Locations in Albert Street / Dura Street

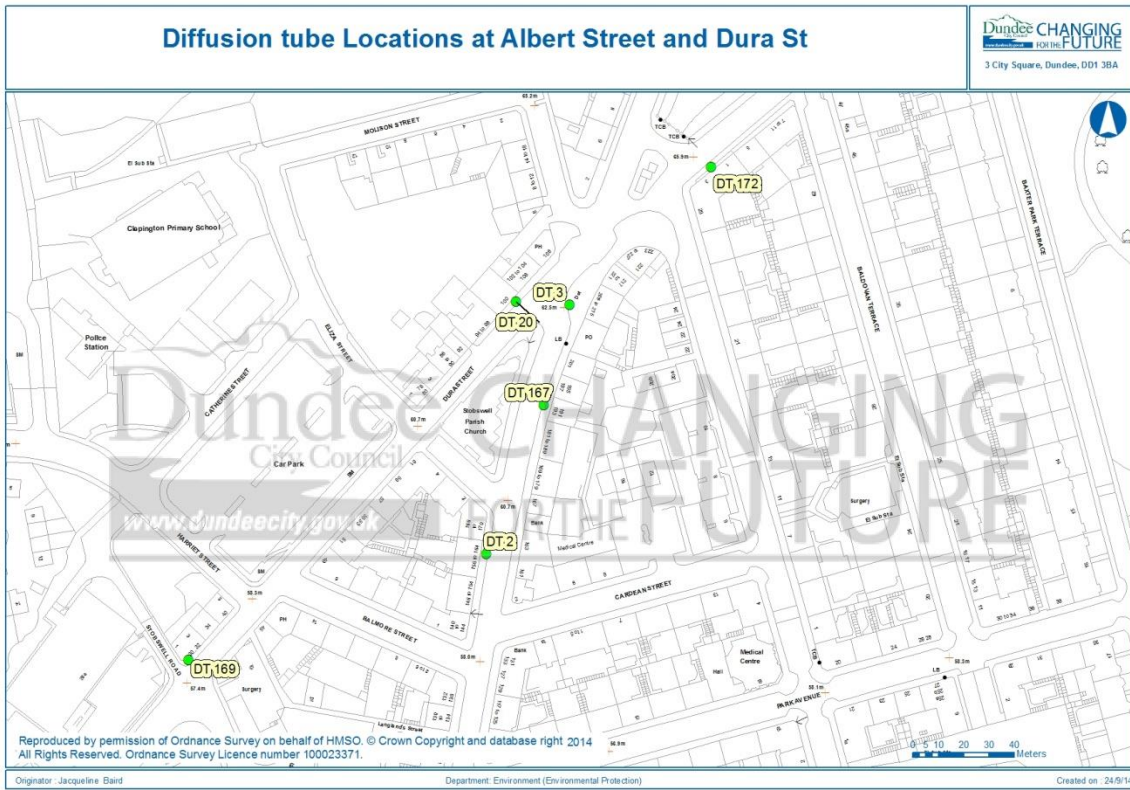
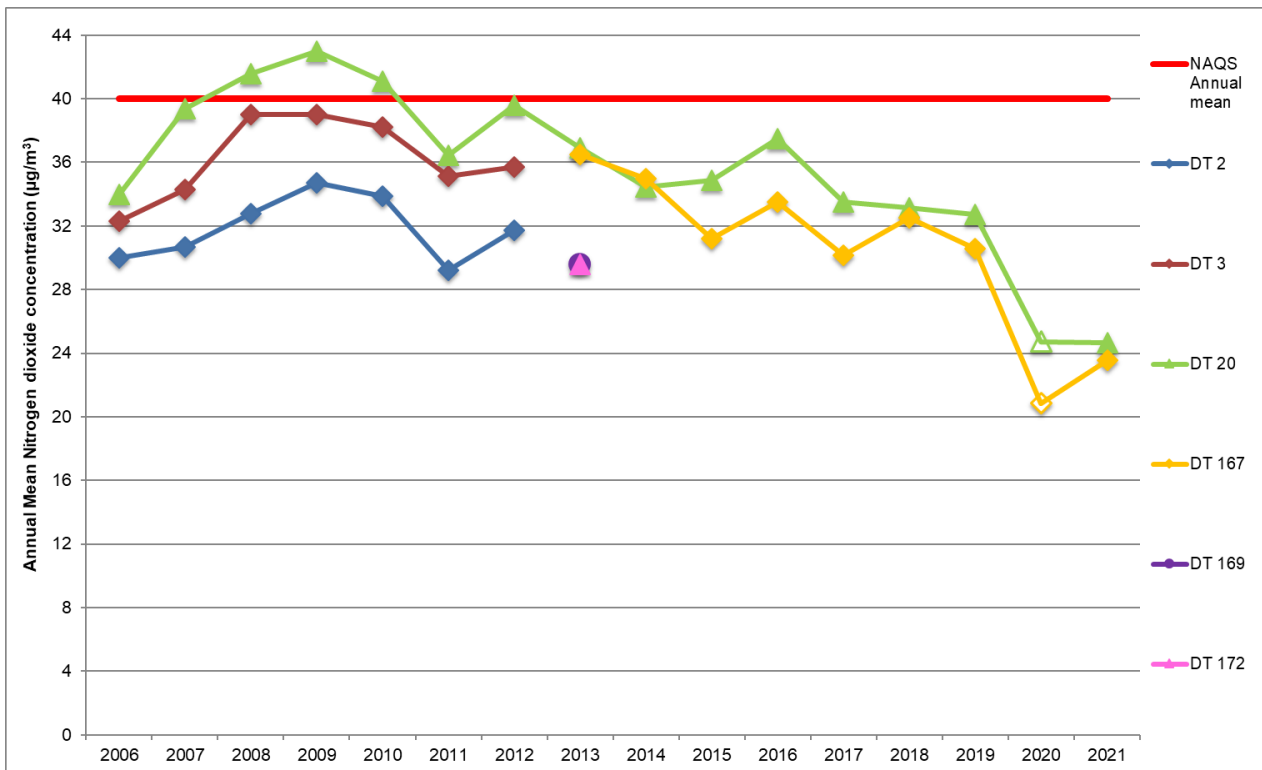


Figure D.11 Overview of NO<sub>2</sub> Diffusion Tube Concentrations in Albert St / Dura St



Lochee Road

Figure D.12 NO<sub>2</sub> Monitoring Locations in Lochee Road

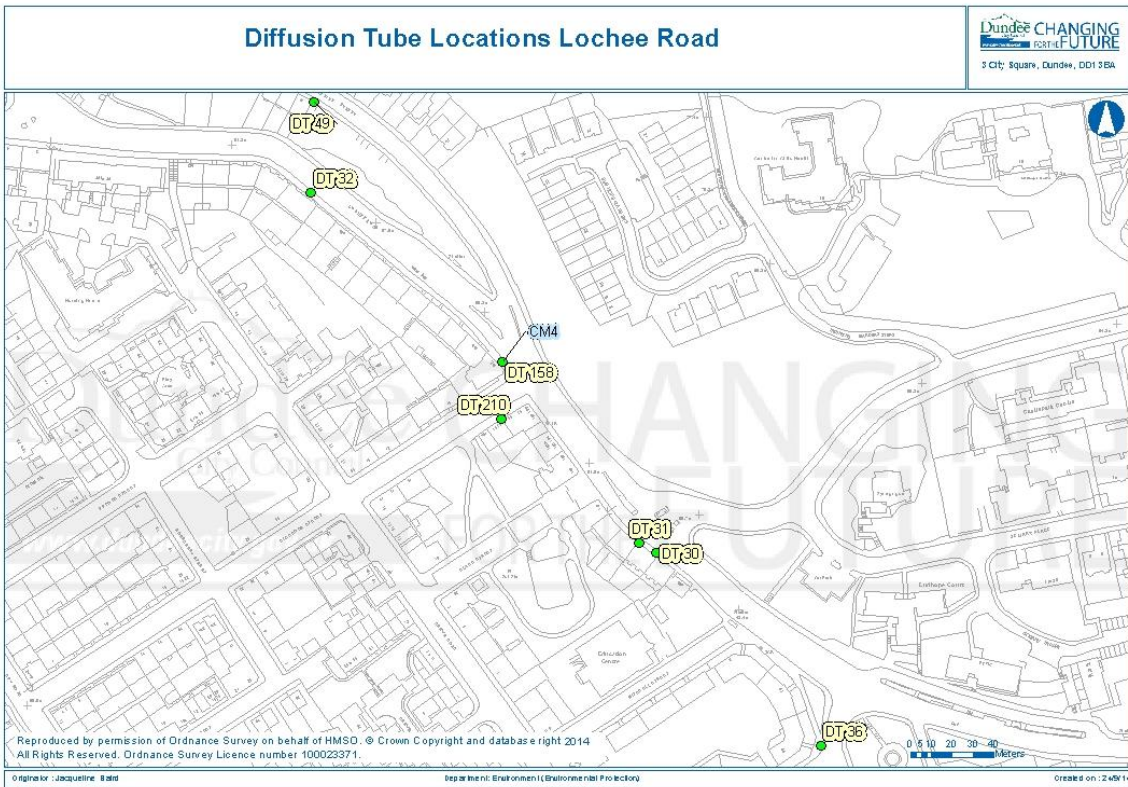
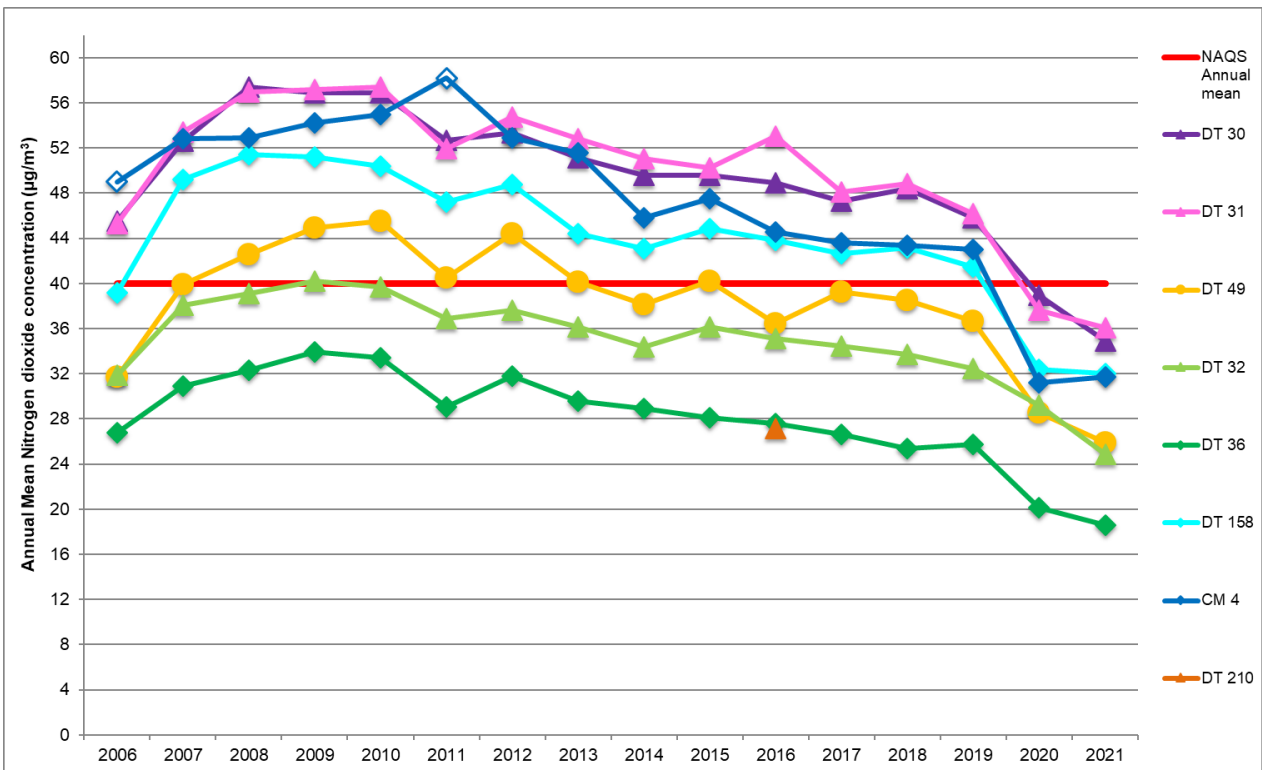


Figure D.13 Overview of NO<sub>2</sub> Concentrations at Lochee Rd



Logie Street

Figure D.14 NO<sub>2</sub> Diffusion Tube Locations in Logie Street

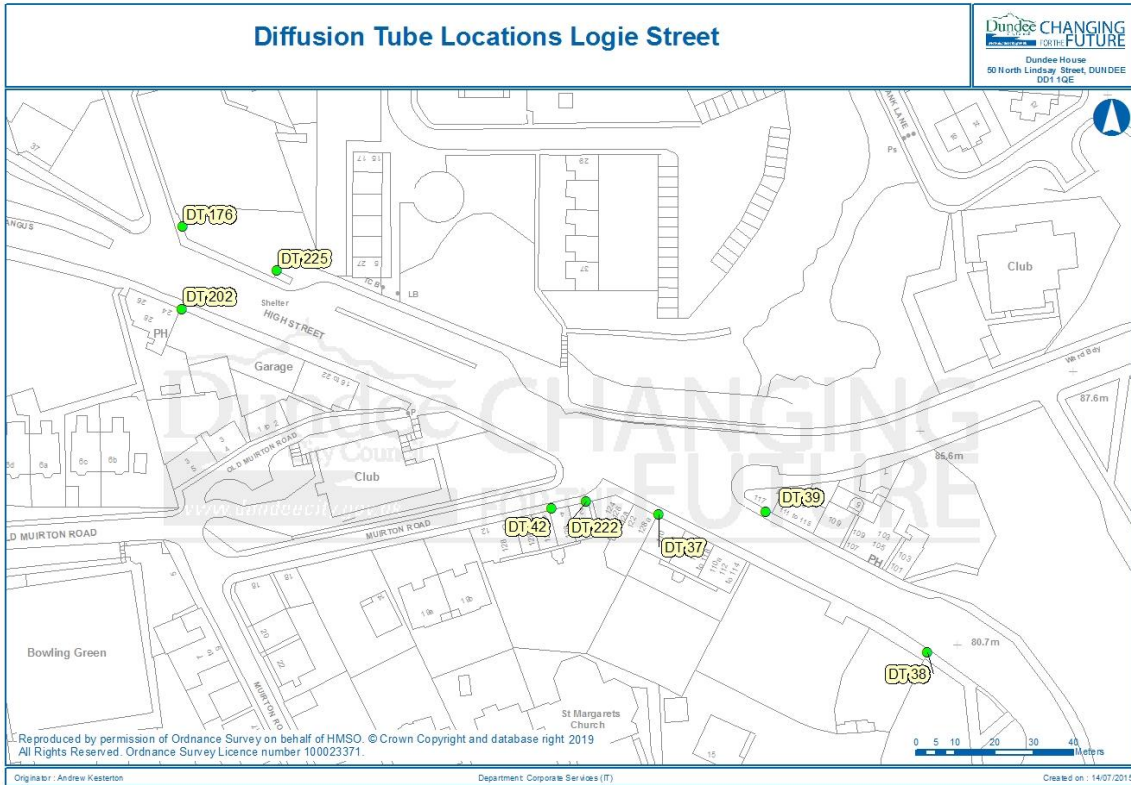
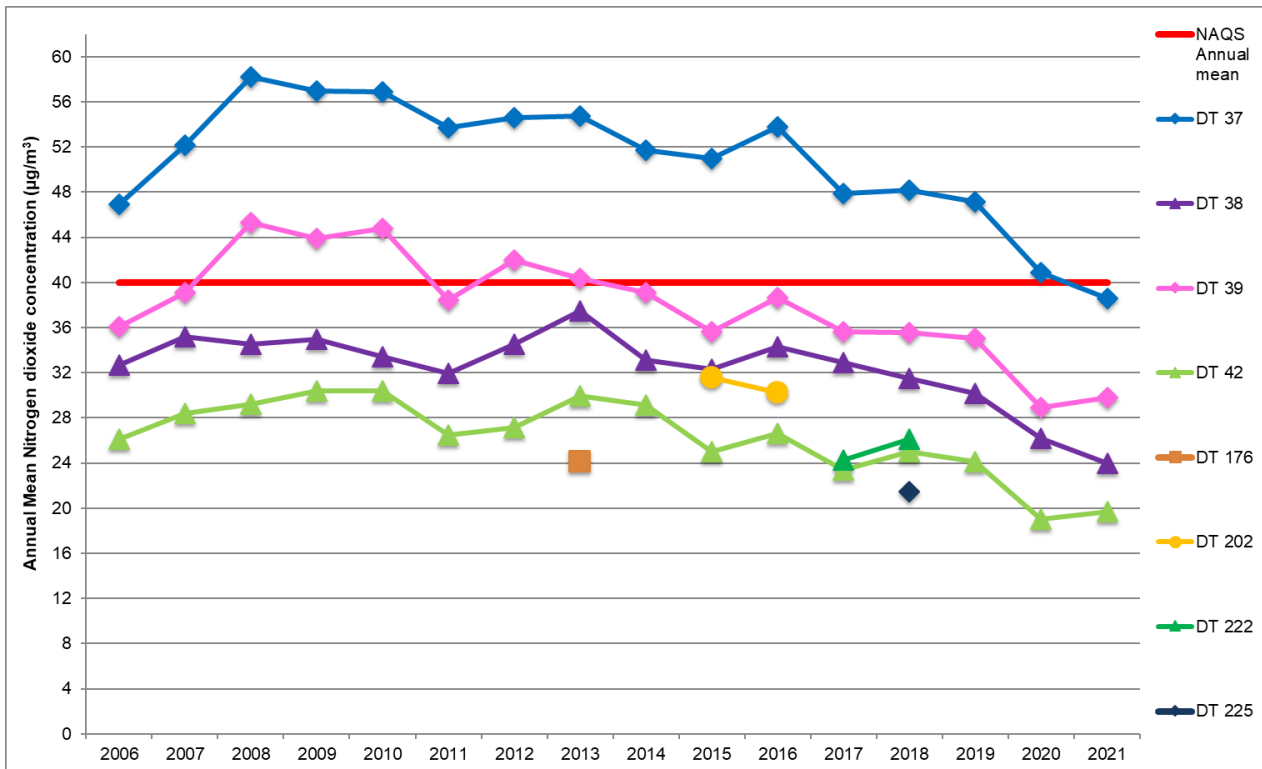


Figure D.15 Overview of NO<sub>2</sub> Diffusion Tube Concentrations in Logie St



Albert Street / Arbroath Road

Figure D.16 NO<sub>2</sub> Diffusion Tube Locations in Albert Street / Arbroath Road

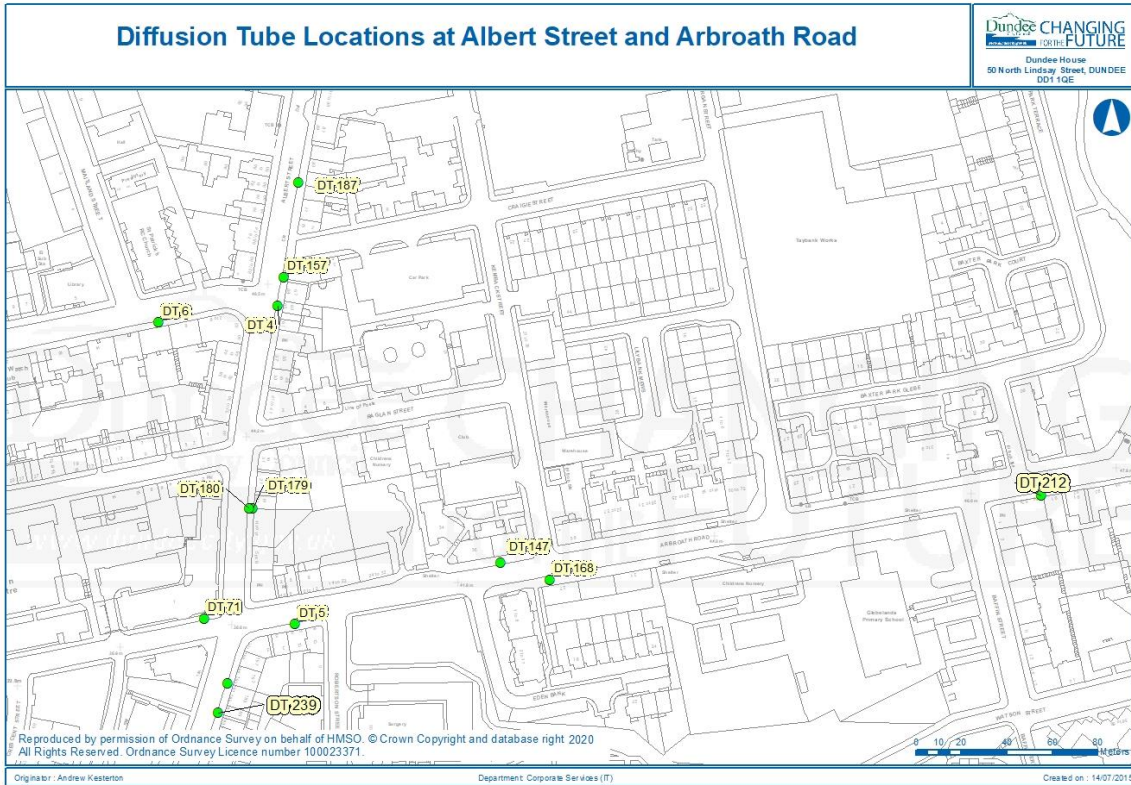
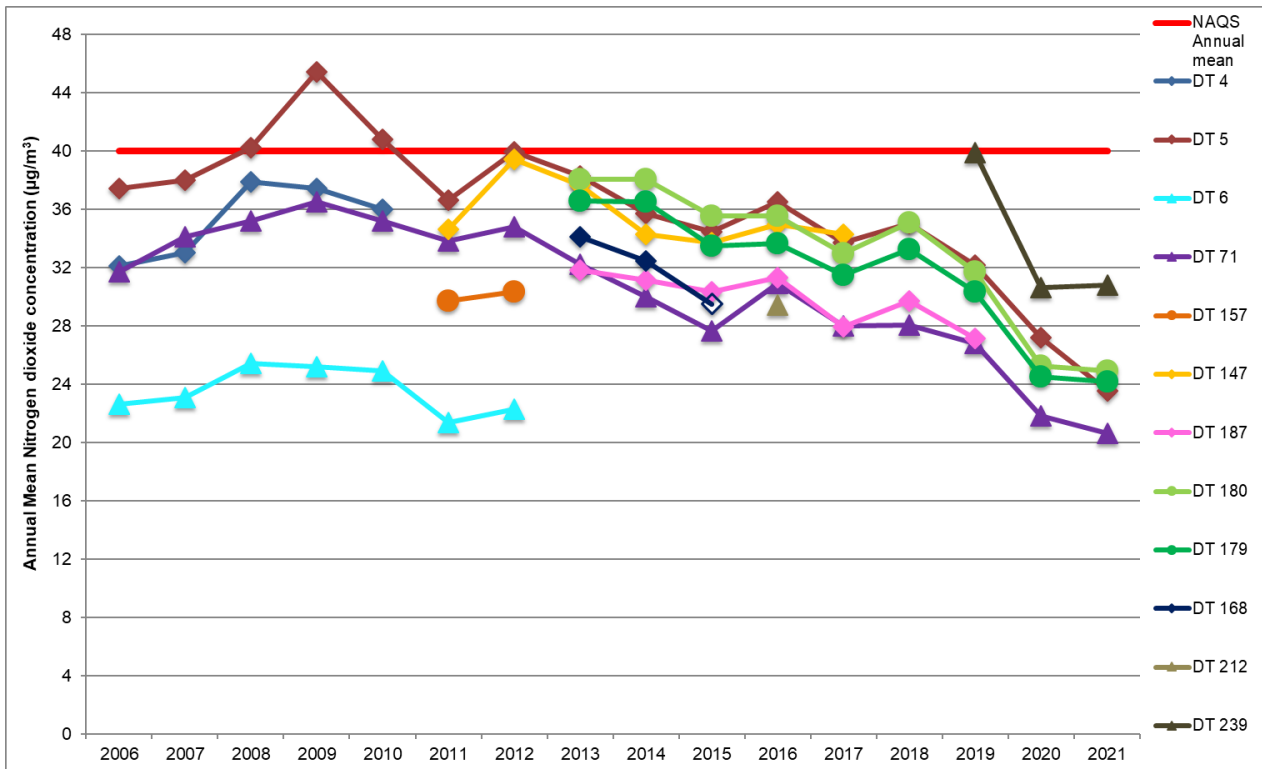


Figure D.17 Overview of NO<sub>2</sub> Diffusion Tube Concentrations in Albert St / Arbroath Rd



Kingsway / Forfar Road

Figure D.18 NO<sub>2</sub> Diffusion Tube Locations on / near the Kingsway

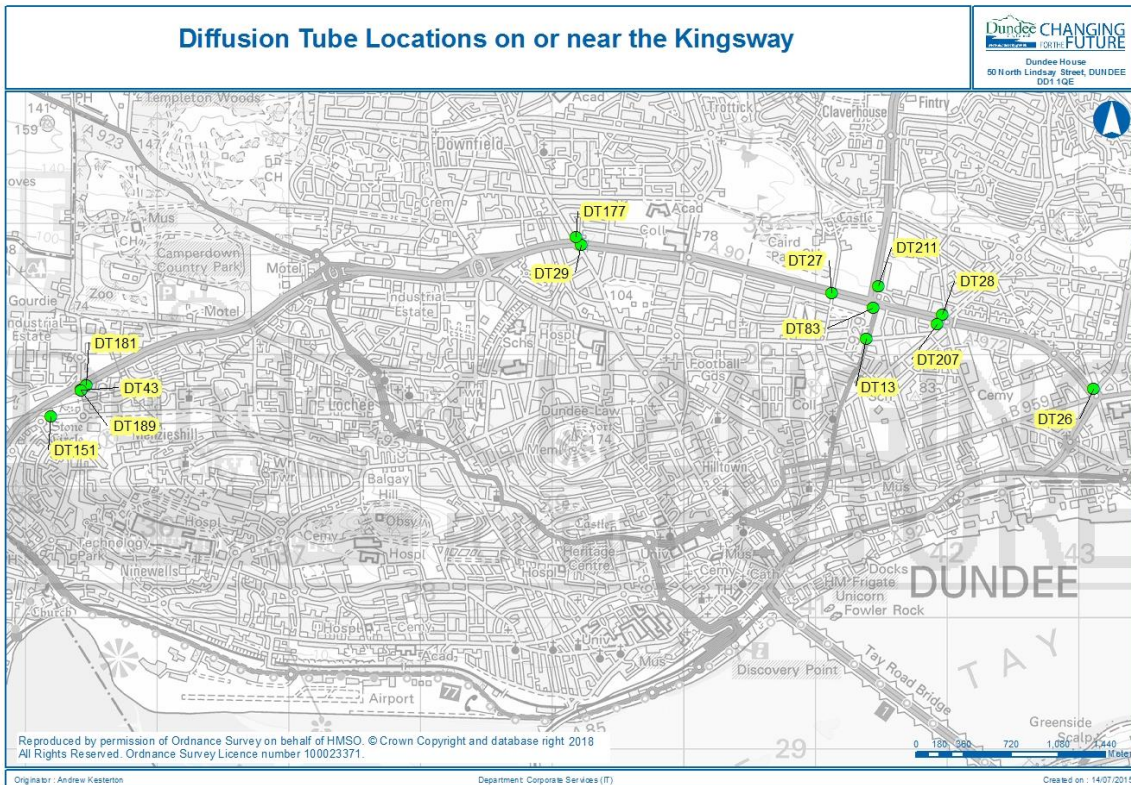
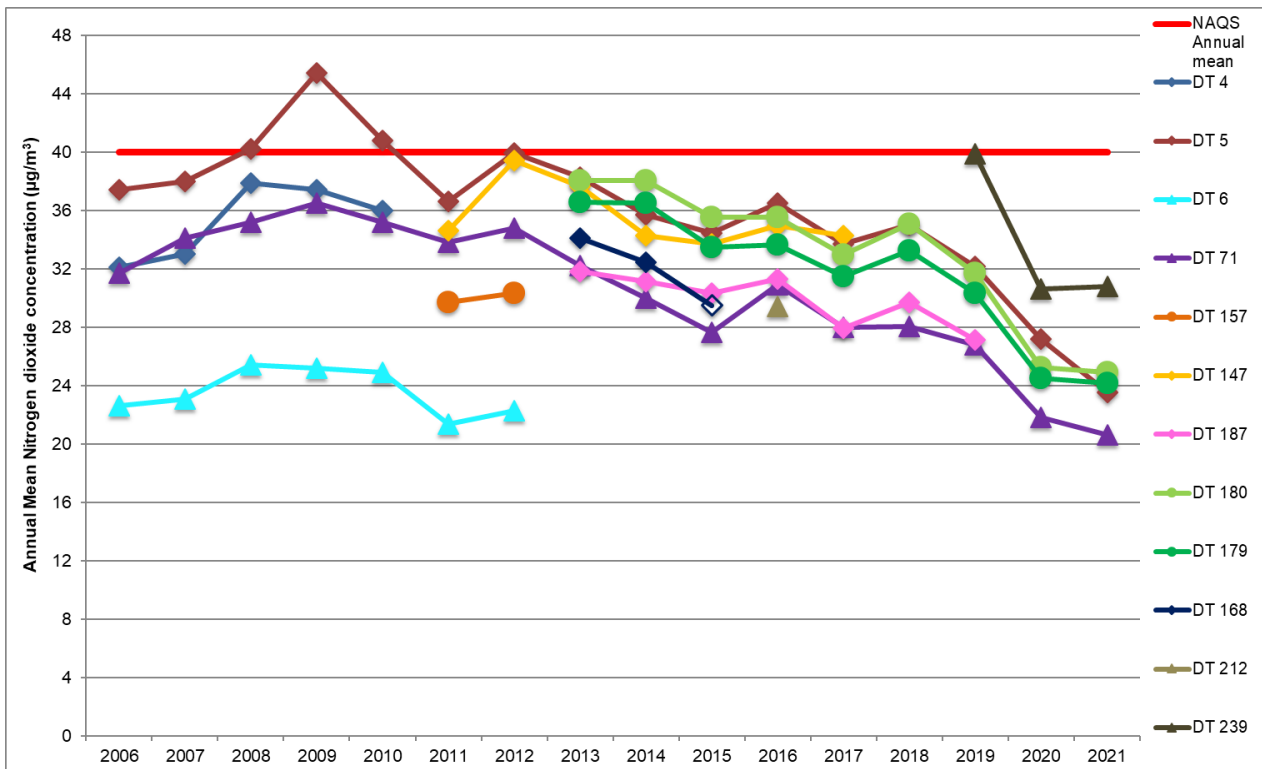


Figure D.19 Overview of NO<sub>2</sub> Diffusion Tube Concentrations on / near the Kingsway



Bus Corridor

Figure D.20 Other NO<sub>2</sub> Diffusion Tube Locations on Bus Corridor

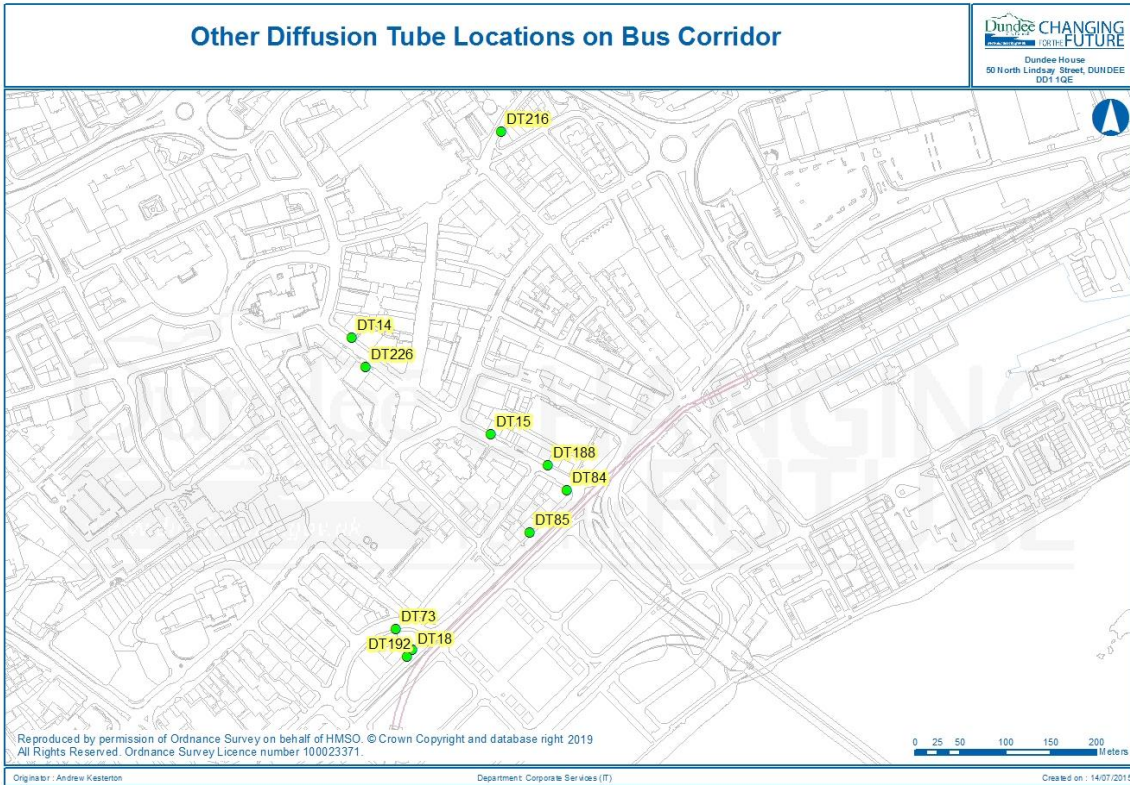
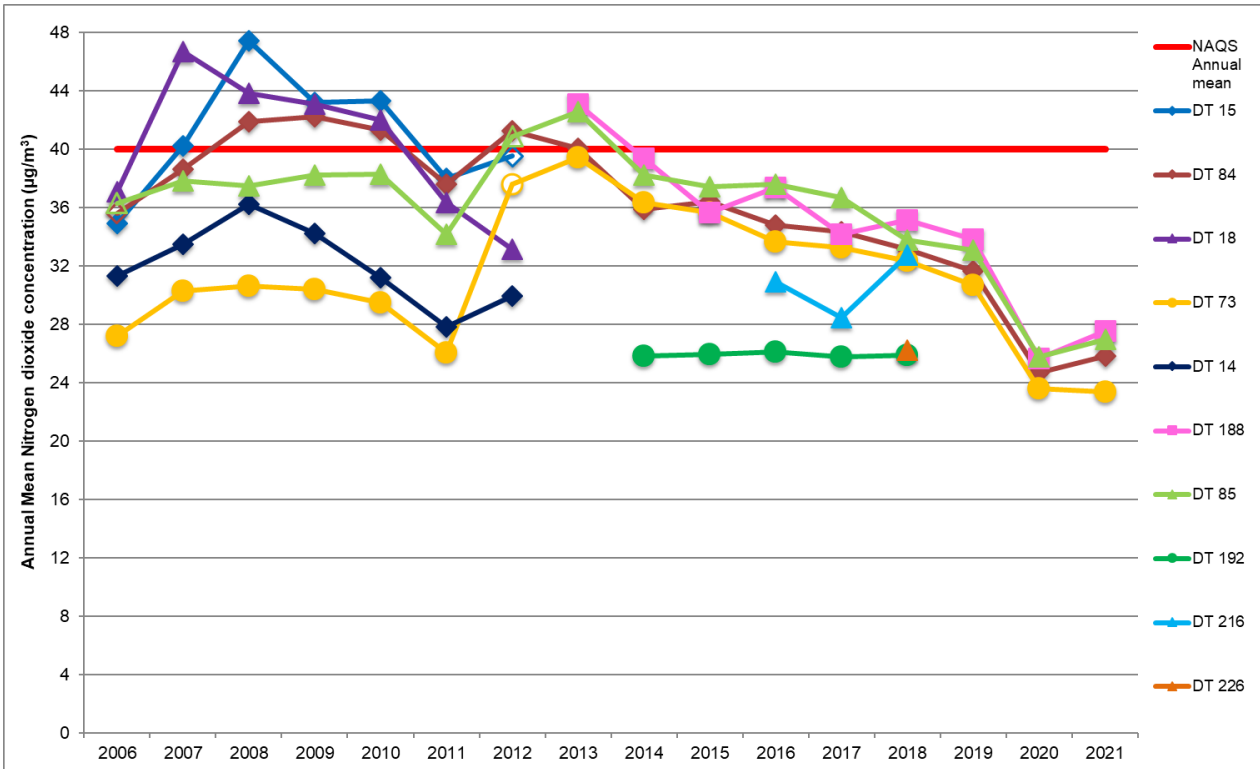


Figure D.21 Overview of NO<sub>2</sub> Diffusion Tube Concentrations on Bus Corridor



Inner Ring Road

Figure D.22 NO<sub>2</sub> Diffusion Tube Locations on Inner Ring Road

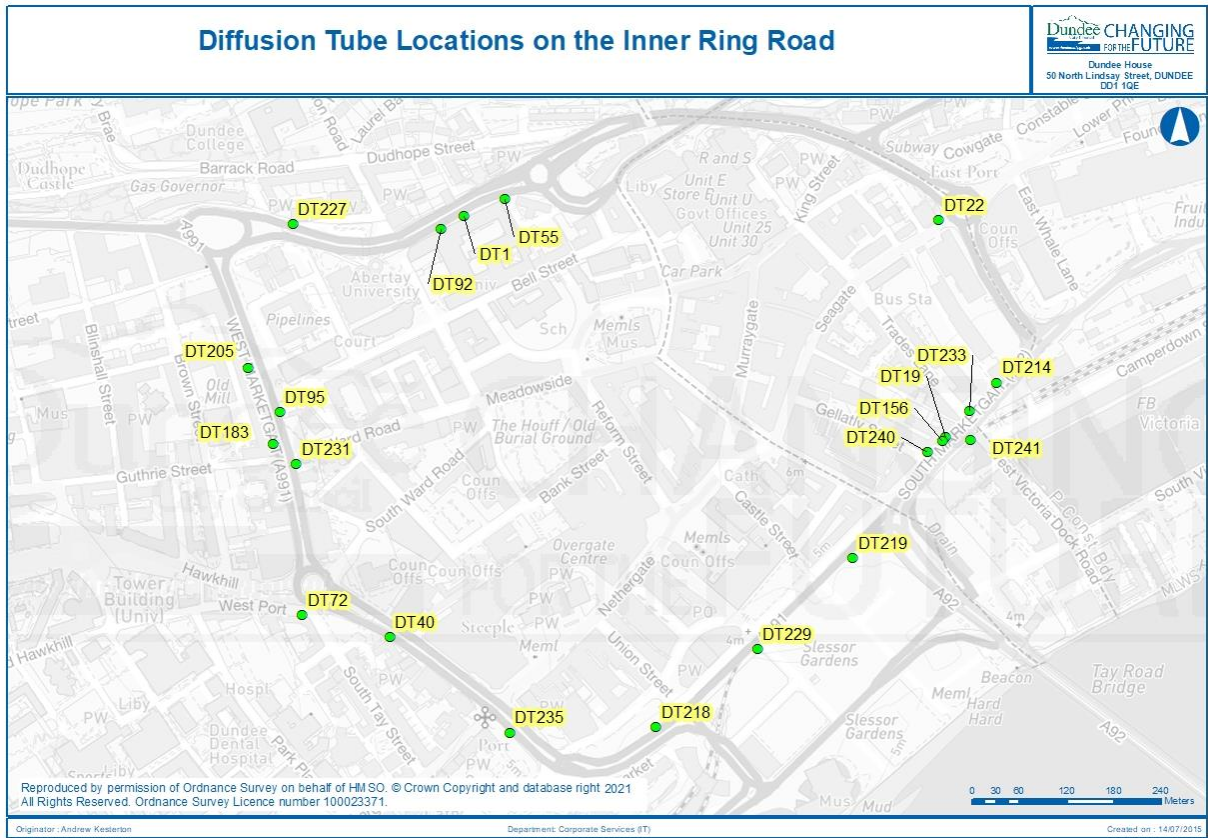


Figure D.23a Overview of NO<sub>2</sub> Diffusion Tube Concentrations on Inner Ring Road (West & North Marketgait)

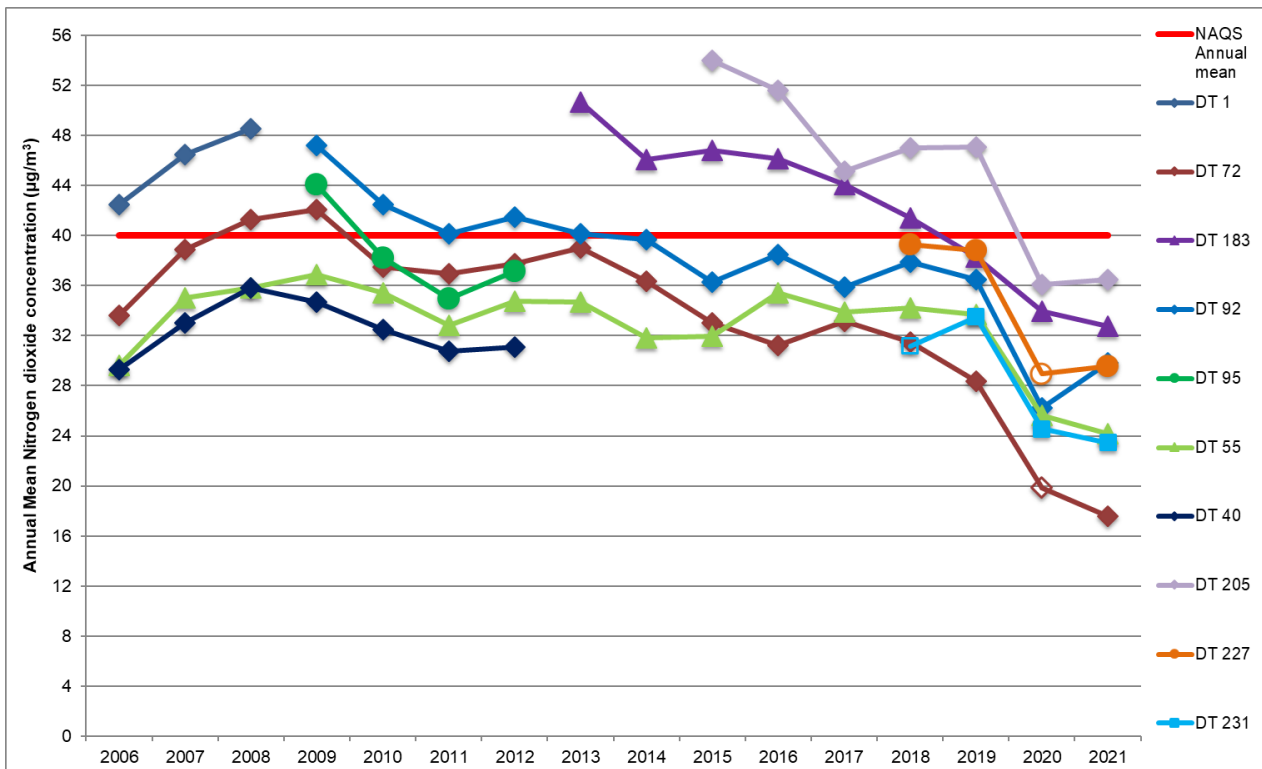
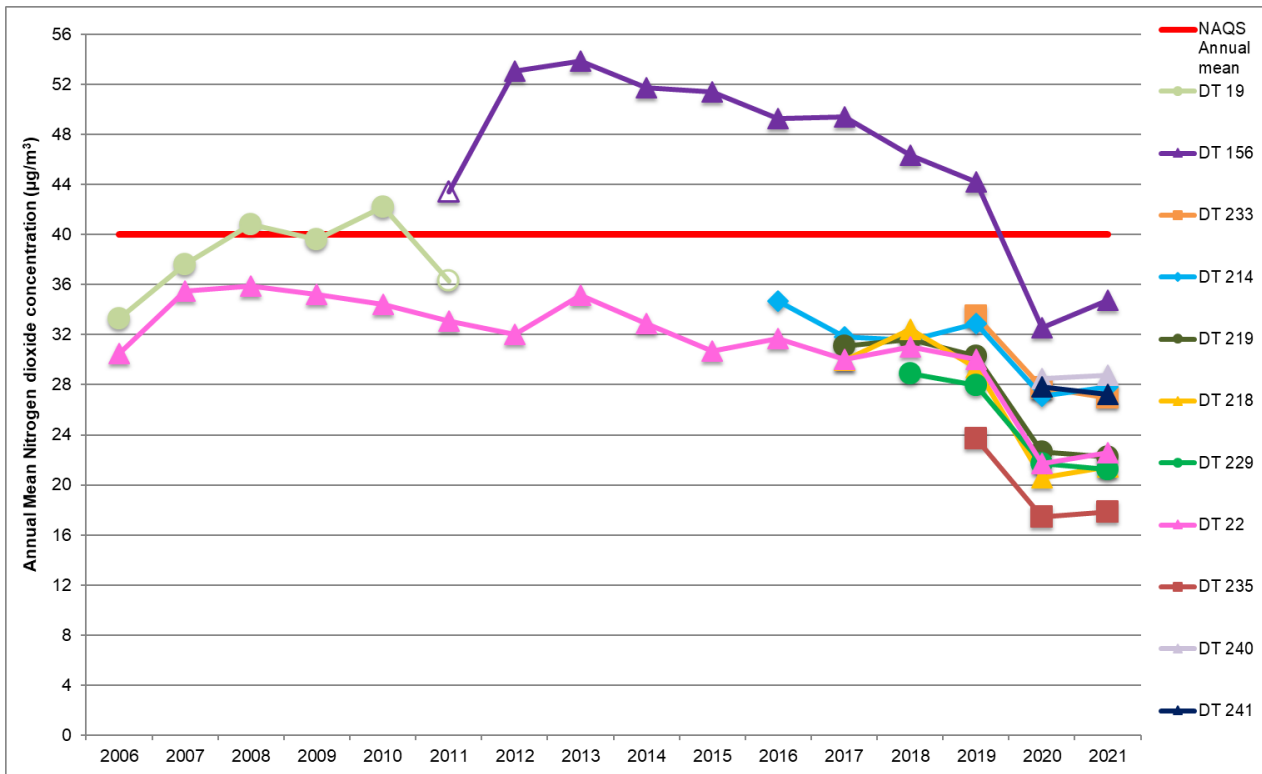


Figure D.23b Overview of NO<sub>2</sub> Diffusion Tube Concentrations on Inner Ring Road (East & South Marketgait)





Stannergate

Figure D.24 NO<sub>2</sub> Diffusion Tube Locations at Stannergate Roundabout

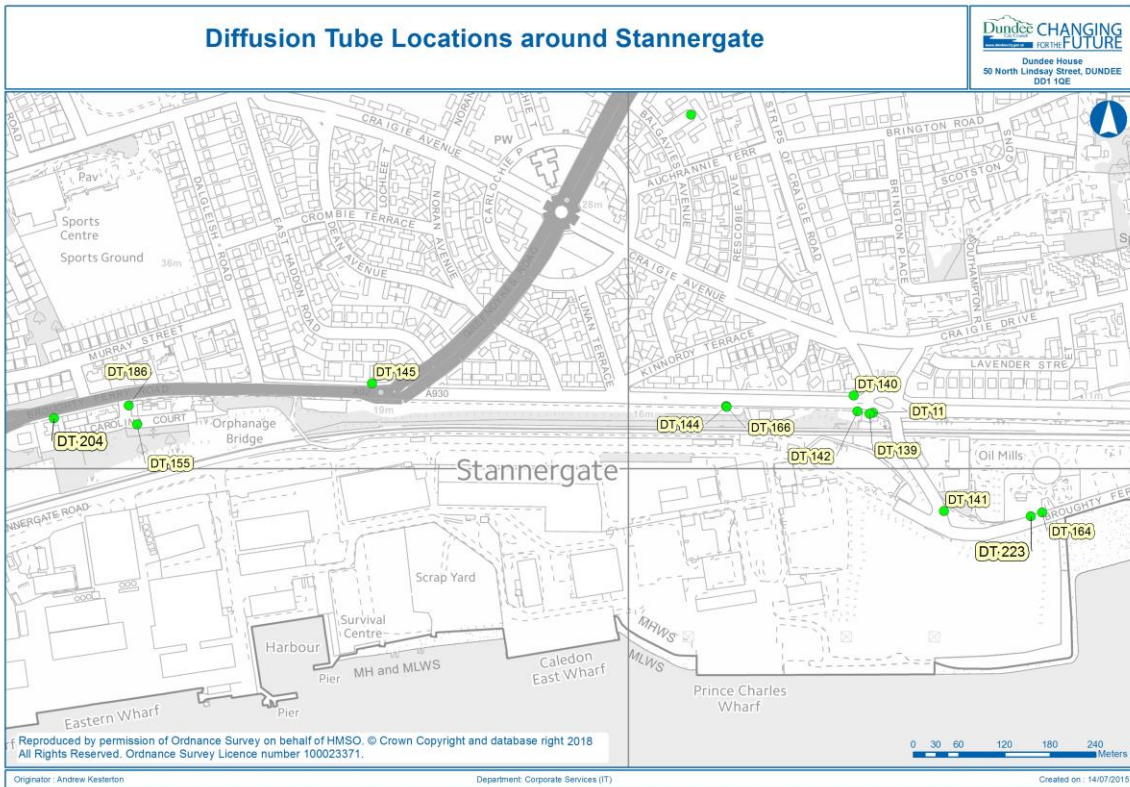
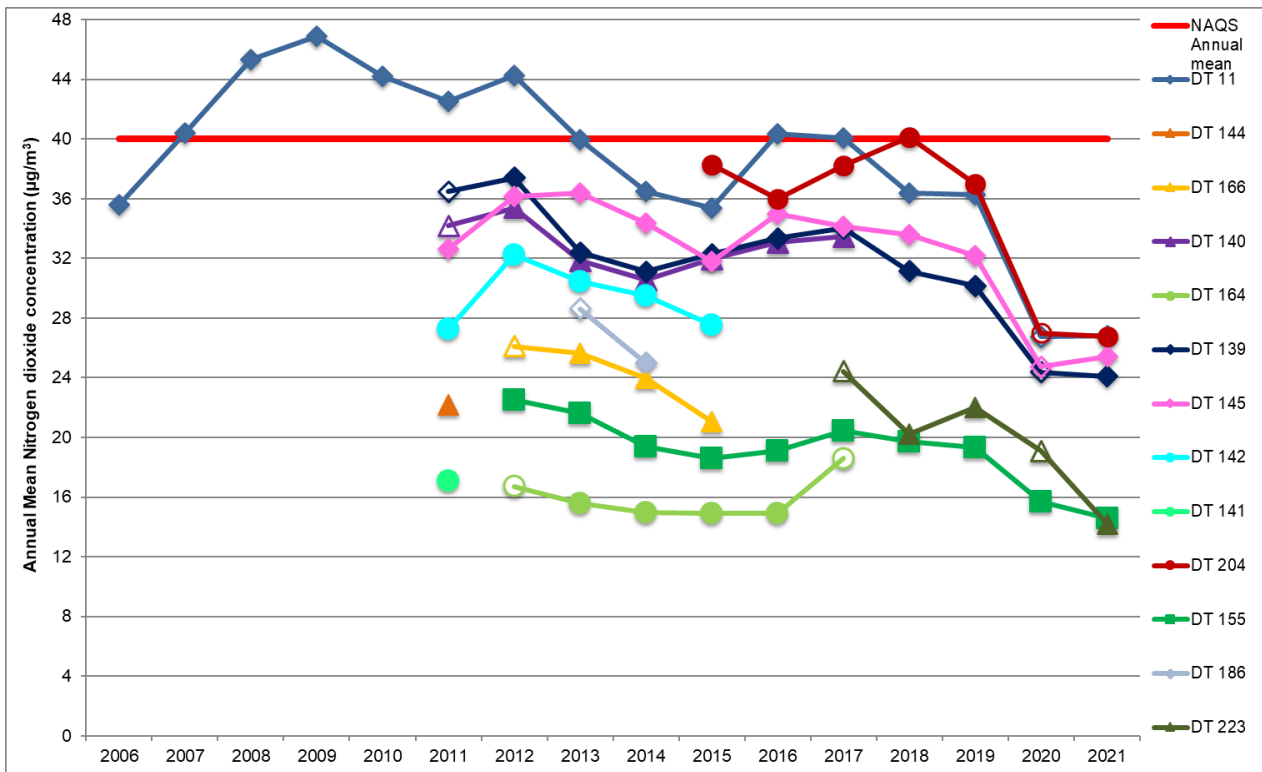


Figure D.25 Overview of NO<sub>2</sub> Diffusion Tube Concentrations at Stannergate Roundabout



Strathmore Avenue

Figure D.26 NO<sub>2</sub> Diffusion Tube Locations at Strathmore Avenue

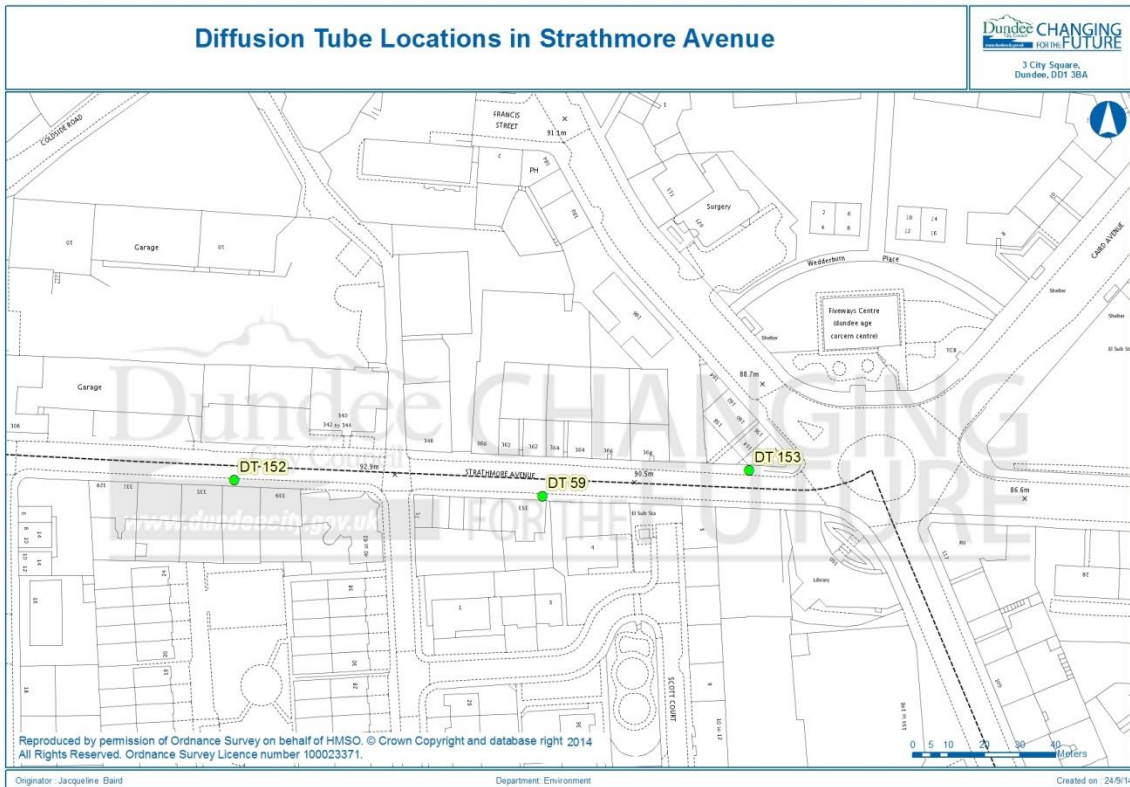
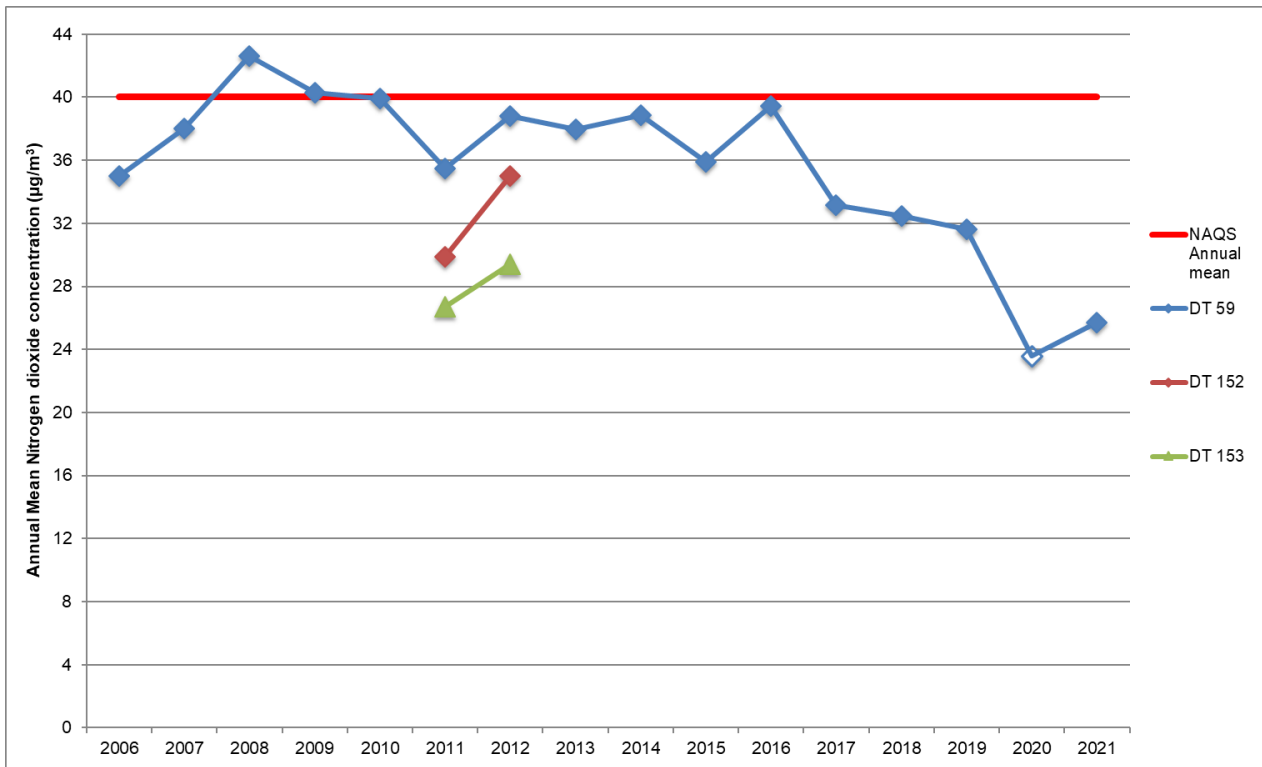


Figure D.27 Overview of NO<sub>2</sub> Diffusion Tube Concentrations at Strathmore Ave



Urban Background Locations

Figure D.28 Urban Background NO<sub>2</sub> Monitoring Locations

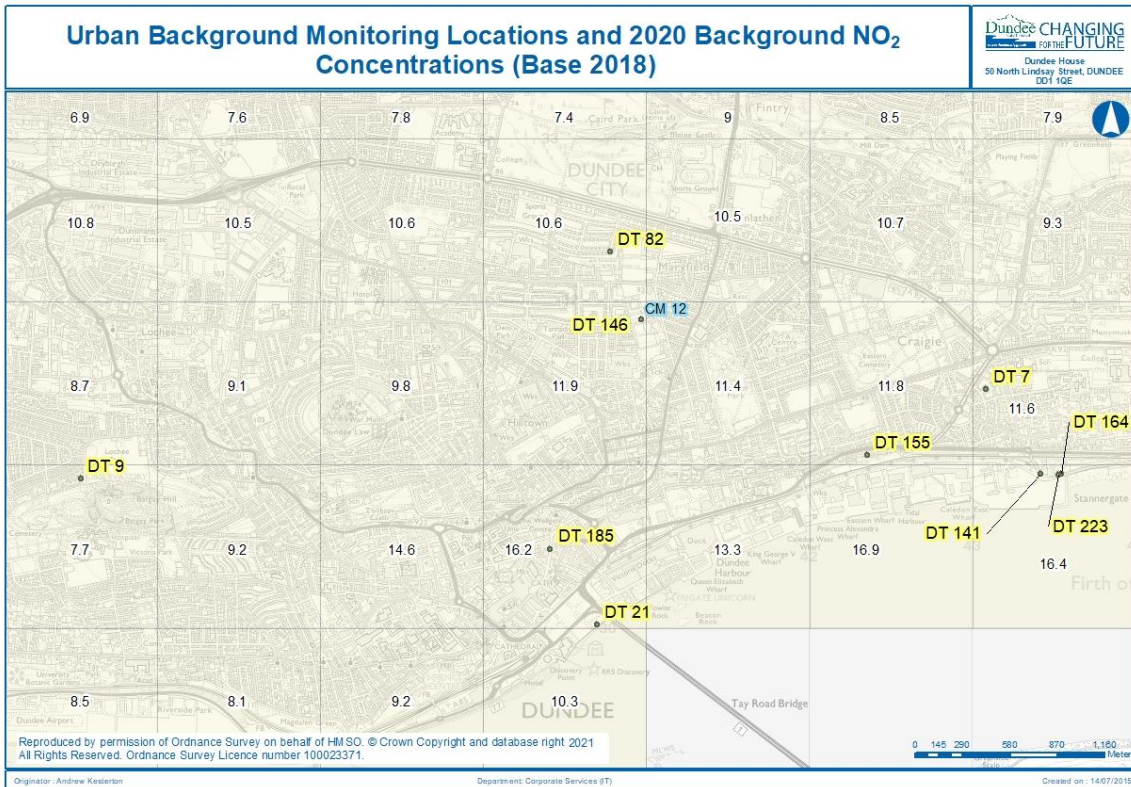
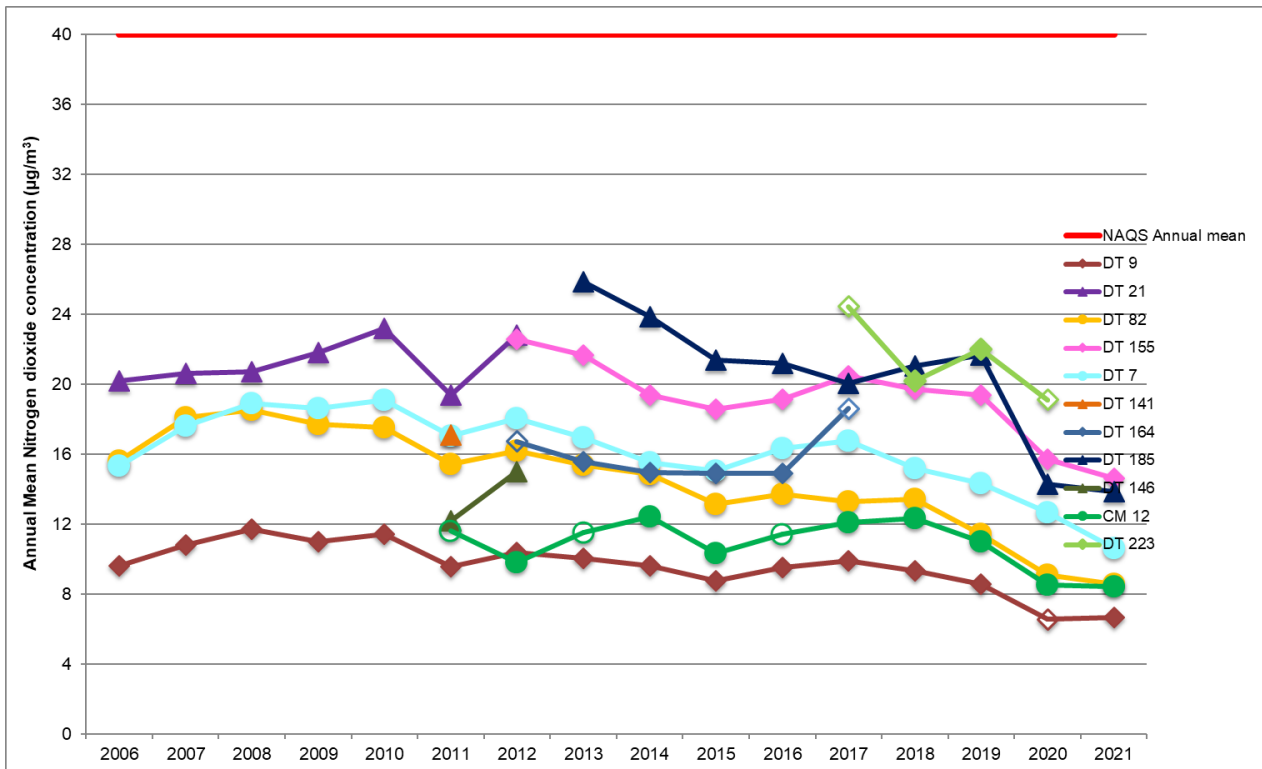


Figure D.29 Overview of NO<sub>2</sub> Concentrations at Urban Background Locations



## Appendix E : Road Traffic data

**Table E.1 Road Traffic Reduction Sites - Annual Average Daily Traffic (AADT)**

RTRA count location	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Bar Chart
Arbroath Rd (E of Kenilworth Ave)	13186	13335	14054	13153	13846	12869	13283	13697	13142	13174	13287	13642	13784	13526	13030	10194	11207	
Blackness Rd (W of Marchfield)	6574	6675	6435	6195	6145	5938	5911	5844	5102	5509	5676	6487	5819	5810	5540	4115	4419	
Broughty Ferry Rd (E of Dalgleish Rd)	31956	31802	31535	30098	27640	27756	27315	24741	29322	30272	26809	28161	29190	29832				
Dens Rd (S of Hillbank Rd)	10852	10664	10672	11023	10833	10083	10062	10178	9744	9707	10315	10322	10756	10409	9961	7900	8723	
Forfar Rd (N of Janefield Pl)	9278	9640	9880	8222	9224	9213	8861	9053	8768	9063	9209	8876	8991	9283	9055	6869	7437	
Hilltown (N of Stirling St)	6024	5710	5895	5701	5753	5656	5416	5492	5608	4268	5782	5828	5491	4601	4392	4491	4668	
Lochee Rd (N of Rankine St)	13477	13681	13438	13286	13296	12983	12684	11603	11285	11880	11821	11770	12453	12928	13135	9943	9080	
Perth Rd (E of Windsor St)	8341	7434	7583	7531	7695	7352	7053	7184	7180	7214	7328	6650	7316	7912	7495	5101	6009	
Pitkerro Rd (S of Baxter Park)	10107	9522	9975	9950	9789	9359	8623	8608	8827	8899	9085	9126	9584	8710	8774	7295	7908	
Rankine St (N of Lochee Rd)	8098	7294	8069	7927	7605	7121	7115	6862	7188	6939	7118	7035	7043	7484	7282			
Riverside Dr (nr Airport)	18875	19056	18918	19045	17907	17654	17024	15900	16213	15932	15923	17343	17503	15791	17315	12794	14985	
Rosebank St (N of Kinloch St)	4821	4867	4722	4623	4528	4603	4426	4489	4621	4587	4655	4615	4183	4015	4070	3326	3604	
Tay Bridge	24475	24686	24748	25045	25406	25235	25484	24753	24770	24925	21762	25993	26631	26633	27250	18312	22048	

Note: 1) Heights of the bars in the charts are relative to the range of values across all sites.

2) The red and blue bars are the highest and lowest count, respectively, at that count location.

**Table E.2 Road Traffic Reduction Sites - Percentage Growth**

RTRA count location	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Bar Chart
Arbroath Rd (E of Kenilworth Ave)	100	101	107	100	105	98	101	104	100	100	101	104	105	103	99	77	85	
Blackness Rd (W of Marchfield)	100	102	98	94	93	90	90	89	78	84	86	99	89	88	84	63	67	
Broughty Ferry Rd (E of Dalglish Rd)	100	100	99	94	86	87	85	77	92	95	84	88	91	93				
Dens Rd (S of Hillbank Rd)	100	98	98	102	100	93	93	94	90	89	95	95	99	96	92	73	80	
Forfar Rd (N of Janefield Pl)	100	104	106	89	99	99	96	98	95	98	99	96	97	100	98	74	80	
Hilltown (N of Stirling St)	100	95	98	95	96	94	90	91	93	71	96	97	91	76	73	75	77	
Lochee Rd (N of Rankine St)	100	102	100	99	99	96	94	86	84	88	88	87	92	96	97	74	67	
Perth Rd (E of Windsor St)	100	89	91	90	92	88	85	86	86	86	88	80	88	95	90	61	72	
Pitkerro Rd (S of Baxter Park)	100	94	99	98	97	93	85	85	87	88	90	90	95	86	87	72	78	
Rankine St (N of Lochee Rd)	100	90	100	98	94	88	88	85	89	86	88	87	87	92	90			
Riverside Dr (nr Airport)	100	101	100	101	95	94	90	84	86	84	84	92	93	84	92	68	79	
Rosebank St (N of Kinloch St)	100	101	98	96	94	95	92	93	96	95	97	96	87	83	84	69	75	
Tay Bridge	100	101	101	102	104	103	104	101	101	102	89	106	109	109	111	75	90	

**Note:** 1) Heights of the bars in the charts are relative to the range for that location.  
 2) The red and blue bars are the highest and lowest percentage growth, respectively, for that site.

## Appendix F : List of industrial processes

Table F.1 List of Industrial Processes

Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments (2019)
Rockwell Solutions, Wester Gourdie, Dundee	Chapter 6: Other Activities Surface treating with organic solvents - Also Chapter 7 SED	6.4.b	No	No	No	No	No	No	Variation in progress. Changes on site mean it's likely there has been a reduction of solvent emissions
MVV Environmental (Baldovie) Ltd Baldovie, Dundee	Chapter 5: Waste Management	Sector 5.1a and 5.1b under PPC 12	No	No	No	Yes, previously assessed	No	No	Substantial Variation for replacement plant issued in February 2019. Planning Application submitted late 2019 to continue use of old incinerator alongside the new one.
Nynas UK AB, East Camperdown Street, Dundee DD1 3LG	Chapter 1: Energy Industries	Section 1.2 Part A Paragraph (f) (i)	No	No	No	Yes, previously assessed	No	No	Site is now effectively a Part B process, but a formal surrender of the Part A has not yet been submitted. Site is

Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments (2019)
									now solely burning natural gas, with a much reduced inventory of bitumen and oil products.
Nationwide Crash Repair Centres Ltd, Liff Road, Dundee	Chapter 6: Other Activities vehicle respraying	6.4.b	No	No	No	No	No	No	No Change
Hanson Aggregates Piper Street, Dundee	Chapter 3: Mineral Industries cement batchers	3.1.a.(ii)	No	No	No	No	No	No	Not operating.
Subsea Protection Systems	Chapter 3: Mineral Industries cement batching	3.1.b	No	No	No	Yes, previously assessed	No	No	Permit surrendered.
Discovery Filling Station	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Brochtay Filling Station	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Asda Stores Filling Station Kirkton	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Tesco Stores Ltd, Methven Street, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	Surrendered 2015
BP Kingsway West Filling Station	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Shell Caird Park	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change

Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments (2019)
Shell UK Ltd, East Kingsway Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	Closed 2015
Asda Stores Ltd, Milton of Craigie, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Tesco Stores Ltd, Riverside Drive, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Tapedrive Ltd, Marketgait F/S, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Sainsburys Supermarket Ltd, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Jet Petrol Station, Forfar Road, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Dens Metals Ltd, West Pitkerro, Dundee	Chapter 2: Production and Processing of Metals	2.2.a	No	No	No	Yes, previously assessed	No	No	Surrendered 2015
Mctavish Ramsay Ltd, Barlow Ave, West Pitkerro	Chapter 6: Other Activities Timber Activity	6.6.(i)	No	No	No	No	No	No	Company in administration. Not operating
Johnsons, Asda Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	Surrendered 2015
Breedon Aggregates Ltd, Longtown Street, Dundee	Chapter 3: Mineral Industries Cement Batching	3.1.a.(ii)	No	No	No	No, previously assessed	No	No	No Change
Aberdeen Valet Service Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	Site no longer operating.	Site no longer operating.	No	No	No	Surrendered 2015



Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments (2019)
Lochee Dry cleaning Centre Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	No Change
Ferry Laundrette Broughty Ferry	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	Not operating since fire in 2016, may become operational again
Stay-Press Dry Cleaning Centre, Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	Surrendered 2015
Care Clean, Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	No Change
Dignity Ltd, Dundee Crematorium, Dundee	Chapter 5: Waste Management	5.1c	No	No	No	No	No	No	No change
Laundry On Line, Annfield Road, Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	permit surrendered March 2016
Wm Morrison Supermarkets Plc, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	No	No	No	No Change
Wm Morrison Supermarkets plc, I Afton Way	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	No Change
Tesco Filling Station, South Road, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	No	No	No	No Change
Halley Stevensons (Dyers & Finishers) Limited, Baltic Works, Annfield Road, Dundee DD1 5JH	Chapter 6: Other Activities	Section 6.4 Part A Paragraph (a)	No	No	No	No	No	No	No Change

Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments (2019)
Discovery Flexibles, Kemback St Dundee	Chapter 6: Other Activities surface treatment using organic solvents also Chapter 7 SED coating flexible packaging	6.4.b	No	No	No	No	No	No	Replacement of one of the process lines with updated equipment. May mean slight change to emissions but not likely to be significant. Variation in progress.
J T Inglis, Riverside Works, Dundee	Chapter 6: Other Activities Textile Treatment	6.4.d	No	No	No	No	No	No	Site Closed 2016, surrender application ongoing
Michelin Tyre Plant, Dundee	Chapter 6: Other Activities surface treatment of rubber with organic solvents also Chapter 7	6.4.b	No	No	No	Yes, previously assessed	No	No	Plant was still operating in 2019 but since has ceased operating
Michelin Tyre Plant, Dundee	Chapter 1: Energy Industries, Combustion	1.1.a	No	No	No	Yes, previously assessed	No	No	Plant was still operating in 2019 but since has ceased operating.
D C Thomson Printers, Dundee	Chapter 6: Other Activities printing process	6.4.b	No	No	No	No	No	No	Not operating but still permitted.

Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments (2019)
Day International Ltd, Balgray St, Dundee	Chapter 6: Other Activities surface treatment of rubber with organic solvents	6.4.b	No	No	No	Yes, previously assessed	No	No	Not operating at present.
RMC Readymix Ltd, Dundee	Chapter 3: Mineral Industries, Cement Batching	3.1.a.(ii)	No	No	No	No	No	No	No change
Brown & Tawse Steelstock Ltd, Fowler RD West Pitkerro - Dundee	Chapter 6: Other Activities, paint spraying	6.4.a	No	No	No	No	No	No	No Change
Armitages Pet Products Ltd, Broughty Ferry Road-Dundee	Chapter 6: Other Activities, Pet Food Manufacture	6.8.a	No	No	No	No	No	No	Permit surrender received December 2017
Tesco Stores Ltd, Kingsway Retail Park Dundee	Chapter 1: Energy Industries, Petrol Station	1.2.c.(ii)	No	No	No	No	No	No	No Change
Joinery and Timber Creations (65) Ltd,	Chapter 6: Other Activities, Timber Process	6.6.(i)	No	No	No	No, previously assessed	No	No	Waste wood boiler- permitted but not operating.
Ethiebeaton Quarry	Chapter 3 Mineral Activities - cement batching process 3.1a(ii), roadstone coating 3.5e, crushing and grinding 3.5c	3.1a(ii), 3.5e, 3.5c	No	No	No	Yes, previously assessed	No	No	No change
Health Care Environmental Services, Nobel Road, Wester Gourdie Ind. Estate	Chapter 5 Waste Management Part A Treatment of Clinical waste	5.3a	No	No	No	No, previously assessed	No	No	Site still permitted but facility closed.

Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments (2019)
Petrol Filling Station, Asda, Myrekirk Road	Chapter 1: Energy Industries, Petrol Station	1.2.c.(ii)	No	No	No	Yes, but no relevant receptors	No	No	No change
ASKA Energy, 3B Edison Place, Dundee	Chapter 4. Chemical Industry, Part A, Producing organic chemicals (biodiesel)	Section 4, Part A, sub-section b	No	No	No	No (Emissions aren't LAQM pollutants)	No	No	Permit surrender received December 2017. Permit surrendered
Sherburn Cement, Shed 1, Eastern Wharf, Port of Dundee, DD1 3LZ	Chapter 3, Part B, section 3.1 (a)(i) Bulk Storage of Cement	PG 3/01(12)	No	No	No	Yes (possible fugitive emissions of particulates)	No	No	Site permitted 2016 and operating PPC/B/1142921 No change
Crown Timber King George V Wharf Road, Dundee Harbour, Dundee, DD1 3LU	Section 6.6 Part A Wood Products Preservation with. Chemicals	Sector Guidance Note SG11 (draft status at issue)	No	No	No	No (No LAQM pollutants or fugitive emissions)	No	No	Existing process has come into the PPC regime (SEPA reference PPC/A/1132892) as part of the Industrial Emissions Directive. No change
Vericore Ltd, Kinnoull Road, Kingsway West, Dundee, DD2 3XR	Schedule 2 (PPC 2012) SED Part B Production of Veterinary Pharmaceuticals		No	No	No	Yes (possible fugitive emissions of particulates)	No	No	Site permitted 2016 and operating – PPC/B/1141206 No change

Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments (2019)
Augean North Sea Services, Riverside Works, Princess Alexandra Wharf, Stannergate Road, Dundee, DD1 3LU	Chapter 5.3 Part A (b) (ii), (iii), (iv), (vi), (x)		No	No	No	Yes (possible fugitive emissions of particulates)	No	No	Site permitted 2017– started operating May 2018 PPC/A/1151594 substantial variation received Dec 2018 has since been withdrawn at request of applicant
Scotscreed Limited, Fishdock Road, Stannergate, Dundee, DD1 3LU	Chapter 3; Section 3.1 Part B (a) (ii)		No	No	No	Yes (possible fugitive emissions of particulates)	No	No	Site permitted 2017 and operating PPC/B/1155960 No change
Dover Fueling Solutions, West Pitkerro Industrial Estate, 3, Baker Rd, Dundee DD5 3RT	Chapter 6; Section 6.4 Part B (a) coating and paint process		Yes*	No	No	Yes (possible fugitive emissions of particulates)	No	No	Existing process has come into PPC regime due to threshold change. Emissions contained. PPC/B/1180866 (2)

**Notes:** Yes\* see Section 4.3  
 ~ With reference to Annex 2 Appendix E TG.03  
 Part A - Processes shaded purple  
 (1) – see Section 4.3 –New or Proposed installations for which an Air Quality Assessment has been carried out  
 (2) See Section 4.3 – New or Significantly changed installations with No previous Air Quality Assessment

## Glossary of Terms

Abbreviation	Description
AADT	Annual Average Daily Traffic flow
ADMS	An atmospheric air pollution dispersion model
AEA	AEA Energy & Environment
Annualise	the means of estimating an annual mean from a shorter study period mean by comparison with full datasets from background AURN sites
AQ Archive	UK Air Quality Archive
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the LA intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
APR	Air quality Annual Progress Report
AQO	Air Quality Objective
AQS	Air Quality Strategy
ATC	Automatic Traffic Count
AURN	Automatic Urban and Rural Network (UK air quality monitoring network)
Borderline	A concentration that is a potential exceedance (e.g. sites above 36µg/m <sup>3</sup> for NO <sub>2</sub> or 16.2µg/m <sup>3</sup> for PM <sub>10</sub> annual mean)
CAFS	'Cleaner Air for Scotland - The Road to a Healthier Future', was Scotland's first air quality strategy, published in 2015
CAFS2	'Cleaner Air for Scotland 2 - Towards a Better Place for Everyone', is Scotland's second air quality strategy, published in 2021
CHP	Combined Heat and Power
CO	Carbon Monoxide
DCC	Dundee City Council
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EC	European Community
EPA	The Environmental Protection Act 1990
EPAQS	Expert Panel on Air Quality Standards
EU	European Union
FDMS	Filter Dynamics Measurement System

GF	Ground floor
GIS	Geographical Information System
HDV	Heavy goods vehicles and buses
HFO	Heavy Fuel Oil
HGV	Heavy Goods Vehicle
HSL	Health & Safety Laboratory
IPC	Integrated Pollution Control
kerbside	0 to 1 metre from the kerb
LAQM	Local Air Quality Management
LAQM	Local Air Quality Management
LAQM.TG(03)	Local Air Quality Management: Technical Guidance (2003)
LAQM.TG(09)	Local Air Quality Management: Technical Guidance (2009)
LAQM.TG(16)	Local Air Quality Management: Technical Guidance (2016) updated February 2018
LDP	Local Development Plan
LEZ	Low Emission Zone
Limit Value	An EU definition for a mandatory air quality standard of a pollutant listed in the air quality directives
MW	Mega Watts
mg/kg	Milligrams per Kilogram
mg/m <sup>3</sup>	Milligrams per cubic metre
NAEI	National Atmospheric Emission Inventory
NAQS	National Air Quality Standard
NLEF	National Low Emission Framework (part of CAFS)
NMF	National Modelling Framework (part of CAFS)
NO	Nitric Oxide
NO <sub>2</sub>	Nitrogen Dioxide
NO <sub>x</sub>	Nitrogen Oxides
ng/m <sup>3</sup>	Nanograms per cubic metre
NPL	National Physical Laboratory
NRS	National Registers of Scotland
NRTF	National Road Traffic Forecast
OLEV	Office of Low Emission Vehicles
Osiris	the brand name given by Turnkey Instruments Ltd. to their particle measuring nephelometer
PDT	Passive Diffusion Tube
PHV	Private Hire Vehicles
PPC	Pollution Prevention and Control Regulations
P&T	Planning and Transportation

PM <sub>10</sub>	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
PM <sub>2.5</sub>	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
Pb	Lead
percentile	The percentage of results below a given value
ppb	Parts per billion
ppm	Parts per million
QA/QC	Quality Assurance and Quality Control
REAE	Ricardo Energy and Environment
receptor	In this study, the relevant location where air quality is assessed or predicted (for example, houses, hospitals and schools)
roadside	1 to 5 m from the kerb
SCA	Smoke Control Area
SED	Solvent Emissions Directive
SEPA	Scottish Environment Protection Agency
SO <sub>2</sub>	Sulphur Dioxide
SPG	Supplementary Planning Guidance
Street Canyon	A relatively narrow street with buildings on both sides, where the height of the buildings is generally greater than the width of the road
SULP	Sustainable Urban Logistics Plan
TACTRAN	Tayside and Central Scotland Transport Partnership
TEA	Triethanolamine
TEOM	Tapered Element Oscillating Microbalance
UKAS	United Kingdom Accreditation Service
ULEV	Ultra-Low Emission Vehicle
USA	Updating and Screening Assessment
µg/m <sup>3</sup>	Micrograms per cubic metre
VCM	Volatile Correction Method
VOC	Volatile Organic Compound
vpd	Vehicles per day
WASP	Workplace Analysis Scheme for Proficiency



## References

This report includes references where appropriate throughout the text as footnotes.